FOUNDRY
EST. 1902 TRADE JOURNAL
WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL
VOL. 109
No. 2295
Registered at the G.P.O. as a Newspaper
DECEMBER 1, 1960
Offices: John Adam House, John Adam St., London, W.C.2
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910	25 lbs.	10"
916	75 lbs.	16"
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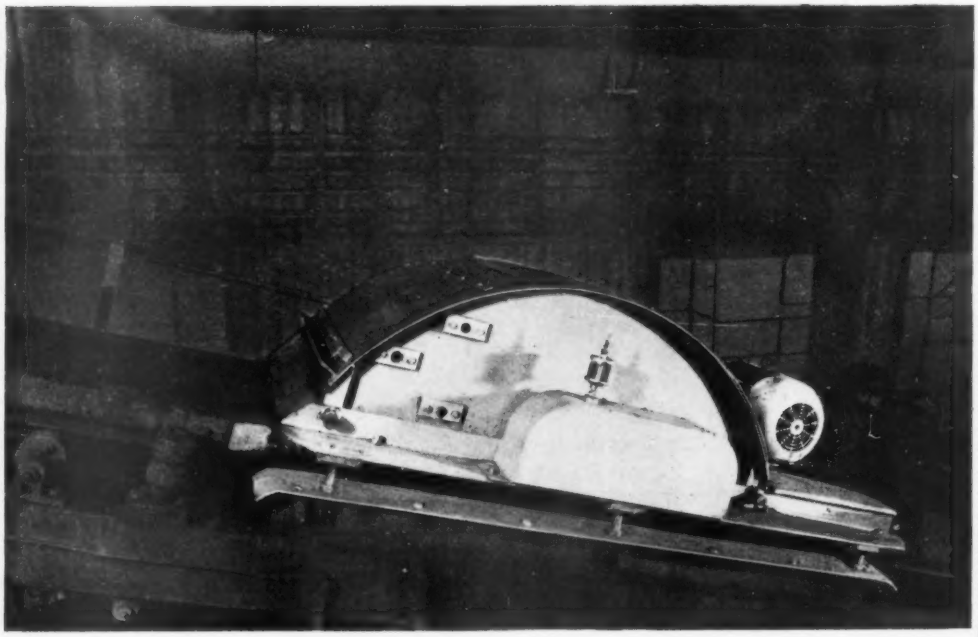

First introduced at the American Foundry Show, Cleveland, in 1958, several of these Aerators have been tried out in various foundries and now we offer them to *you!* We have always been able to offer an efficient Aerator or Disintegrator for any capacity. Now the C.B.M. has arrived !
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- **Available for any hourly sand capacity up to 100 tons per hour.**
- **Suitable for mounting over any width of flat belt conveyor.**
- **Can be incorporated in plants of our own design or in any plant, by anybody, anywhere.**
- **Can be used in new or existing installations.**
- **All you need is a flat rubber conveyor belt on the distribution side of the Sand Plant.**
- **Can easily and quickly be fitted with adjustable brackets or fixings.**
- **No independent supporting structure, platform or chutes needed—just mount it over a flat belt, inclined or parallel to floor level.**
- **No noise, jolting or vibration.**
- **Saves cost of additional supporting steelwork.**

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The newest idea in Sand Aeration

- **Saves Elevator height and ideal for low headroom installations.**
- **C.B.M. is lower priced than other Aerators or Disintegrators.**
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- **Single low-powered electric motor drive—5 to 7½ h.p. is usually ample, even for high outputs.**
- **Vee rope drive and fully lubricated chain drive to twin paddles of special patented design.**
- **Machine is fully guarded.**
- **Quickly removable rubber cover for cleanliness, inspection and maintenance.**
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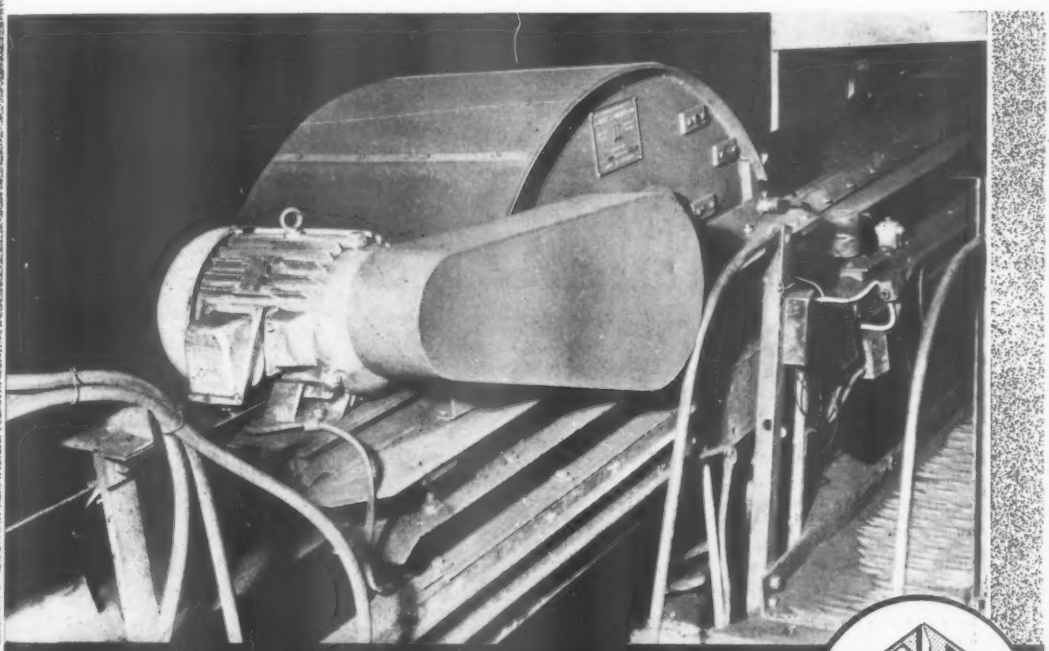

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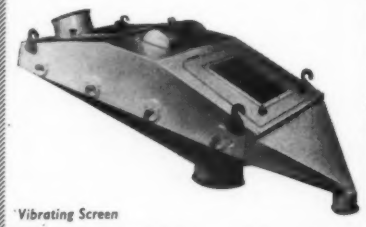

Vibrating Screen

Vibrating Crane Beam

vibratory equipment

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Compared with the practice of screening with a separate power unit, driving belt, etc. the SINEX vibrating screen shows considerable economies in cost and power consumption.

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'MINOR' MAGNETIC FEEDER

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A supplement to the ordinary crane beam making possible the emptying of moulding boxes without the use of large hammers and heavy bars.

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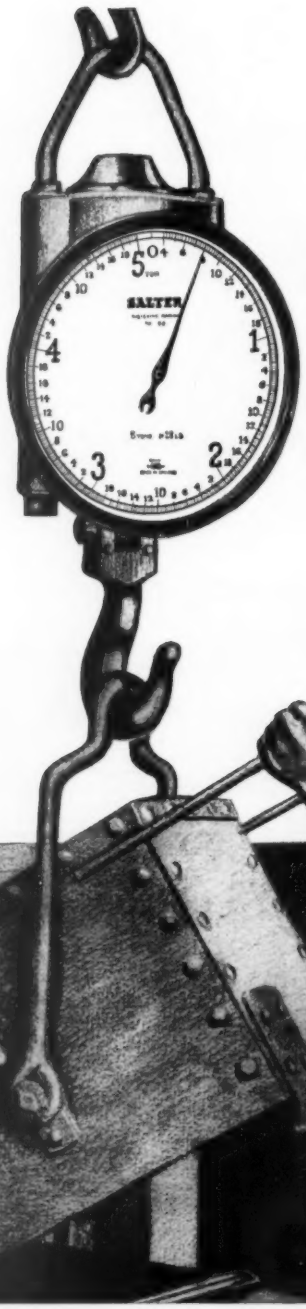

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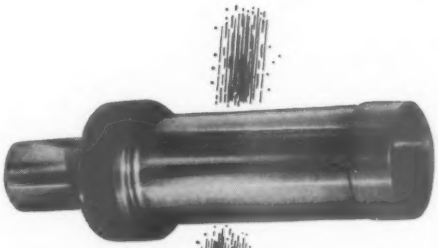

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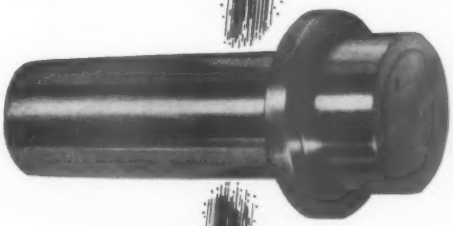

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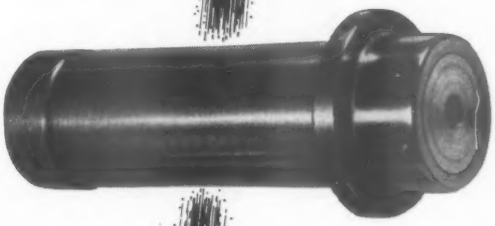

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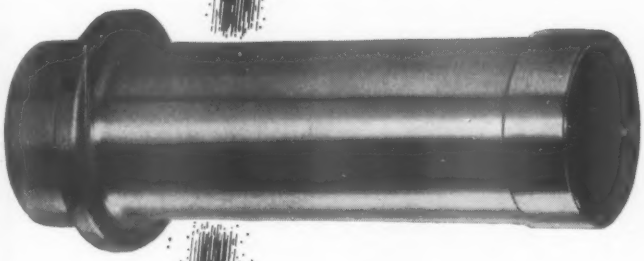

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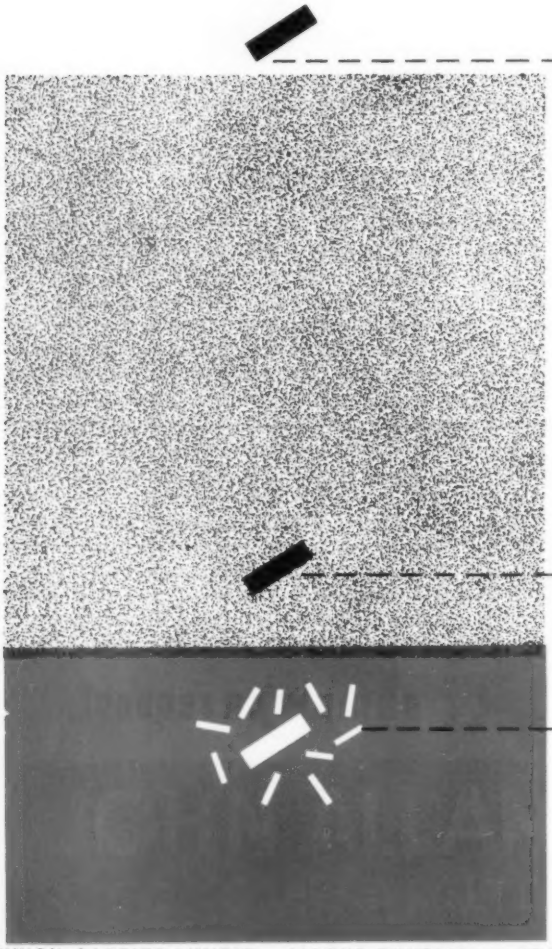

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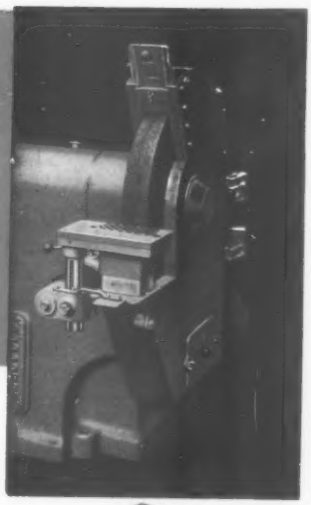

This 16 inch high speed swing frame grinder completely eliminates the dust problem. The dust is taken up at the point of suspension to ensure machine control and balance. It has been filmed in operation by the Factory Inspectorate and complies with all revelant regulations.

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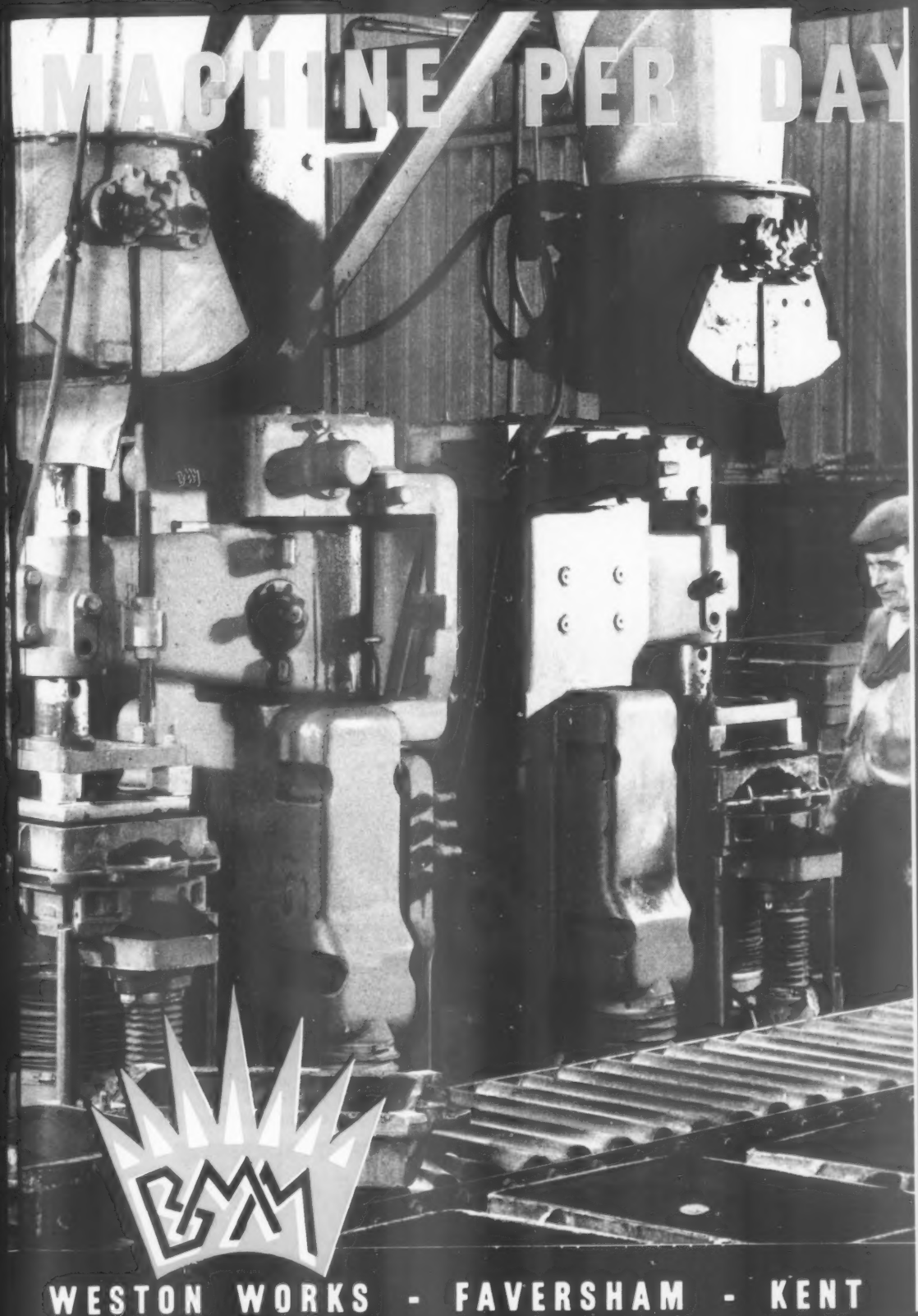
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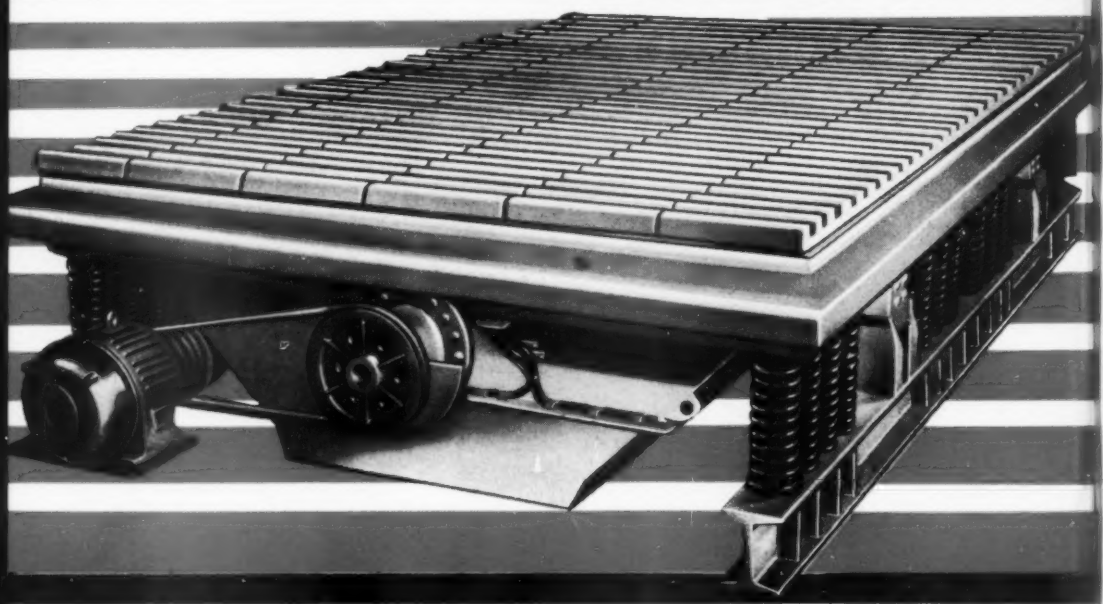

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It is a distinguishing feature of FLOATEX Shakeouts that the vibrations, whilst fast and thorough, are developed without shock. This has the double advantage of preventing damage to the face of the moulding box, and also of being kind to the castings. As the vibrations themselves are fully absorbed by supporting springs and are thus prevented from reaching the foundations only simple foundations are required. Sizes range from a single unit 2ft. by 2ft. up to a sextuple unit 17ft. by 34ft., capacity 150 tons. The size illustrated is a 12ft. by 10ft. duplex unit, capacity 45 tons. Floatex Shakeouts can be engineered into any existing Foundry Layout.

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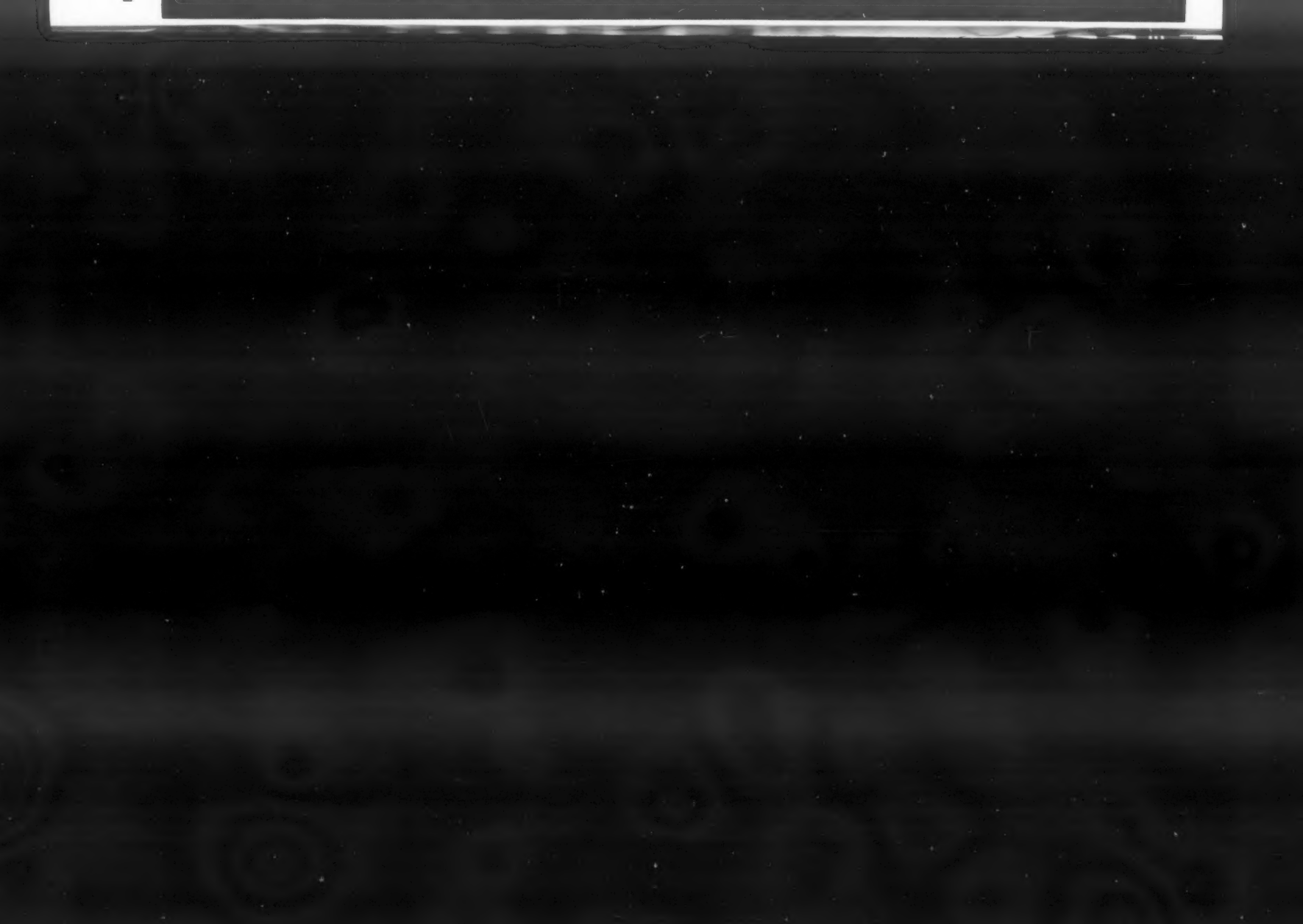

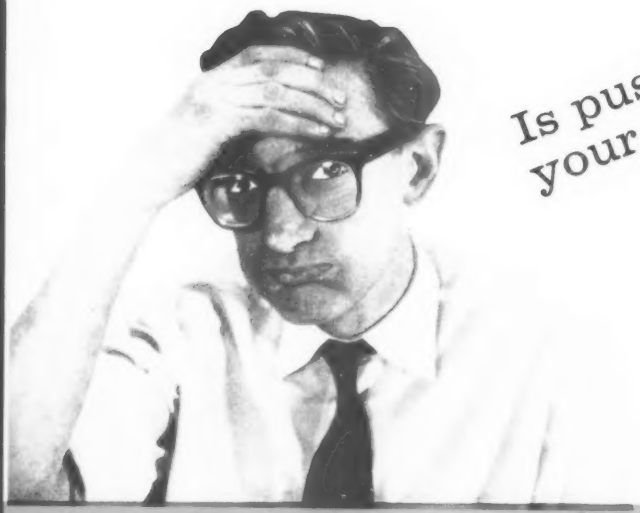

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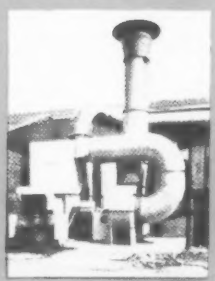
Mine was—and fume removal too, so I had a word with Spencer & Halstead. They examined the problem and installed one of their Spenstead Wet Type Dust Arresters. Presto the problem was solved.



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For individual Dust Control Units or composite plant installation our advice is freely available. Remember we extract the DUST from inDUSTry.

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We solved his problem — what about yours?

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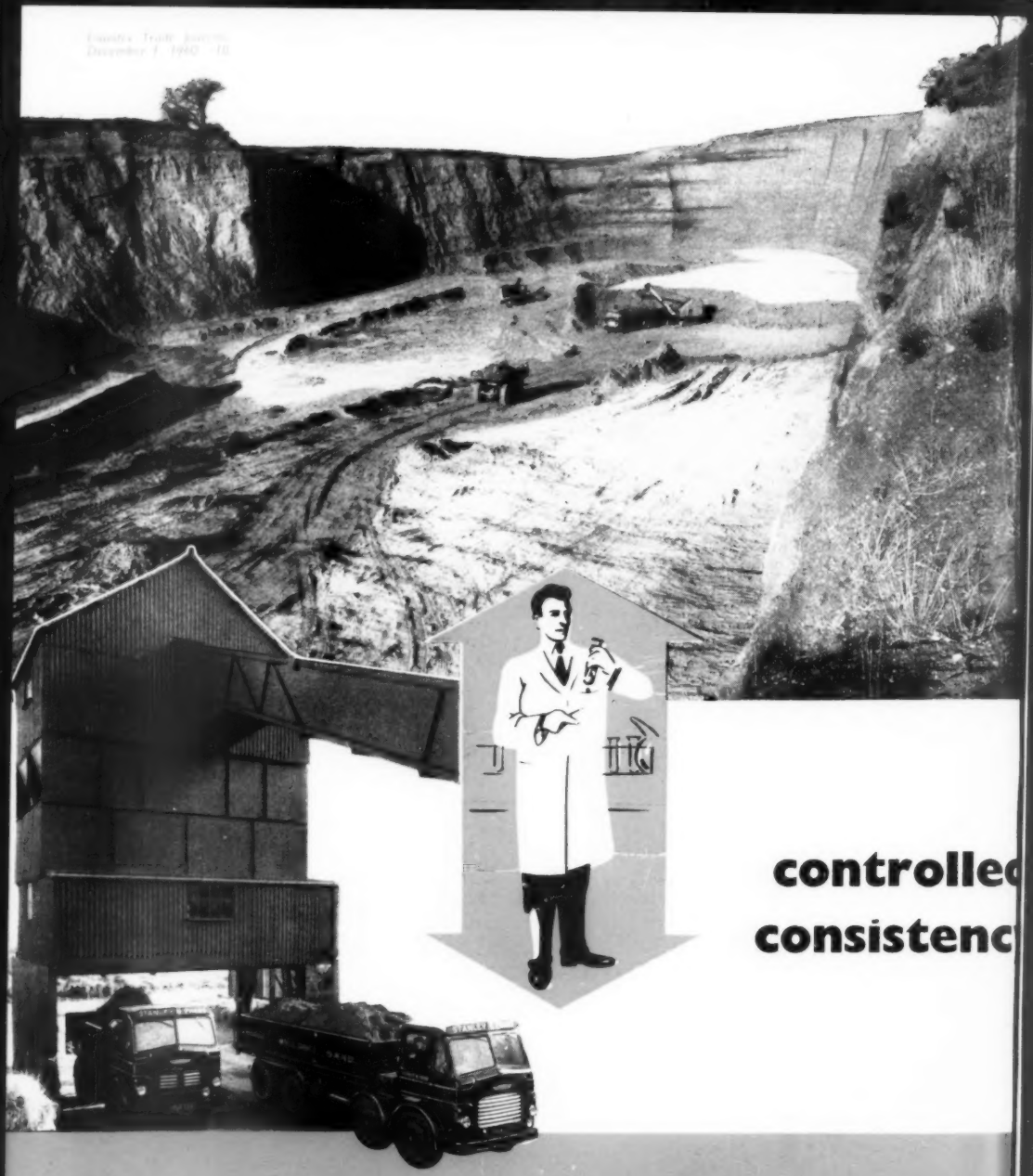

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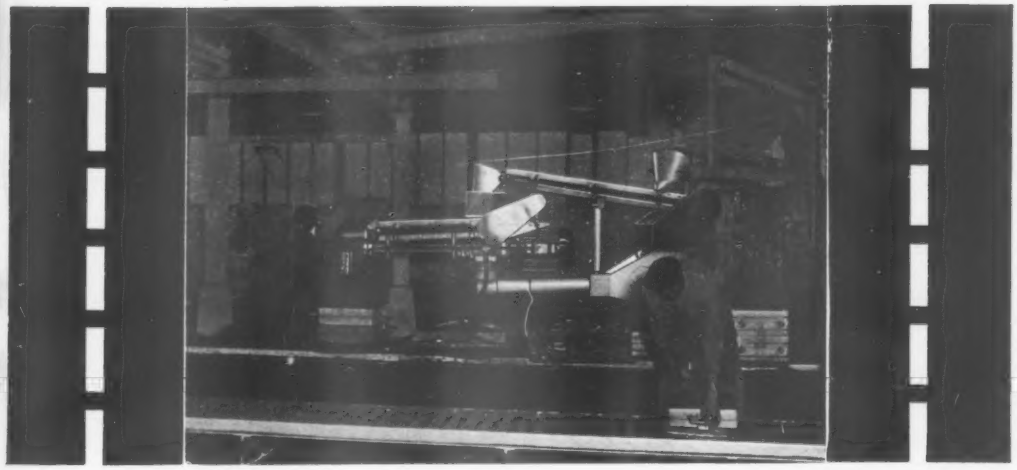

The above photograph, appearing by the kind permission of The Alliance Foundry Co. Ltd., of Luton, Beds., shows one of our Sand Projection Machines No. 6, which has been installed and is now operating in their Foundry.

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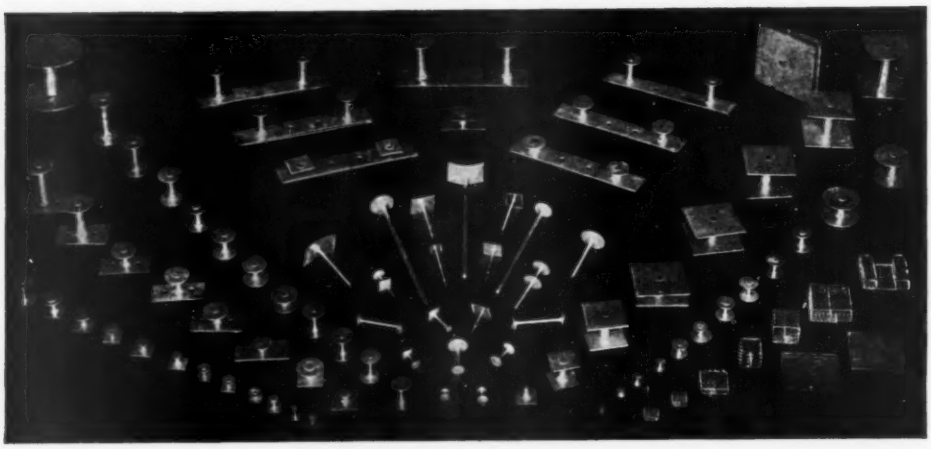

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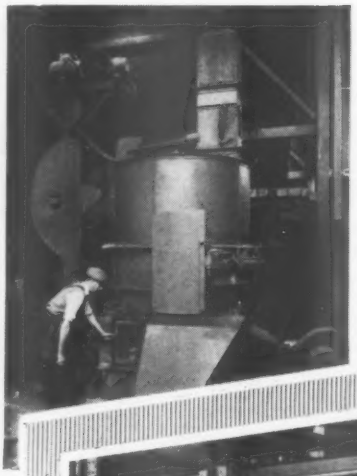

More and more modern foundries are specifying the

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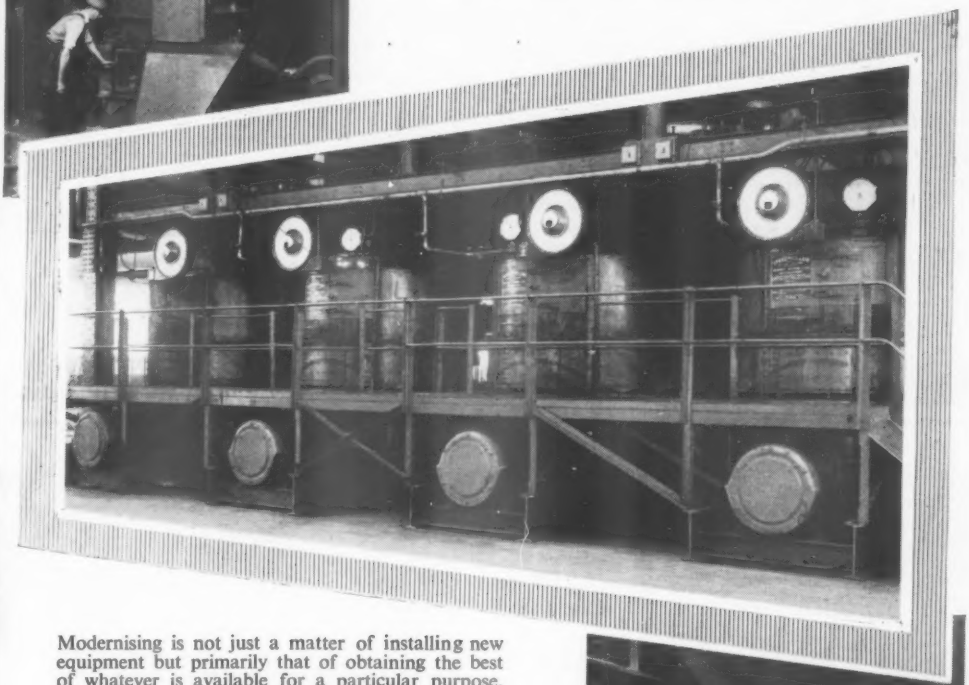

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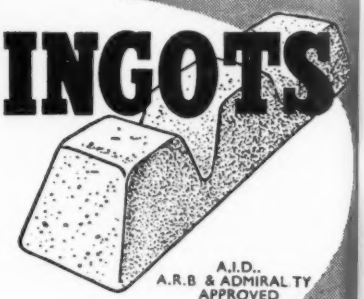

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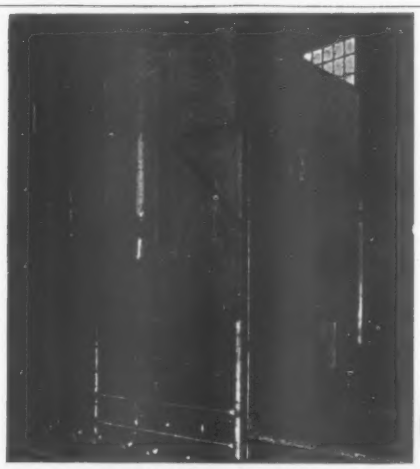

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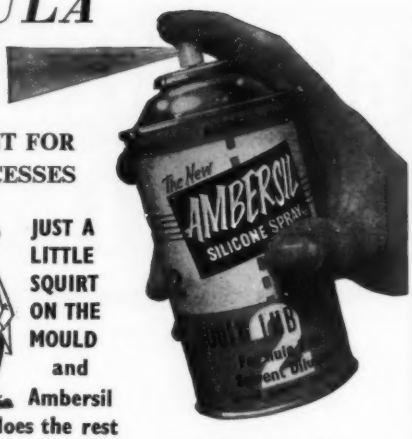

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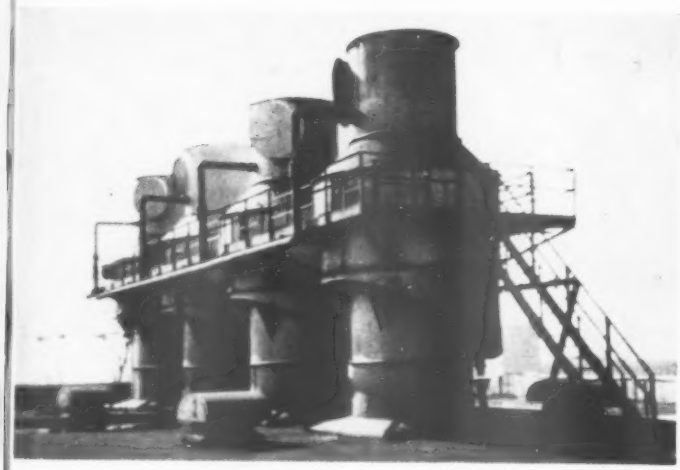

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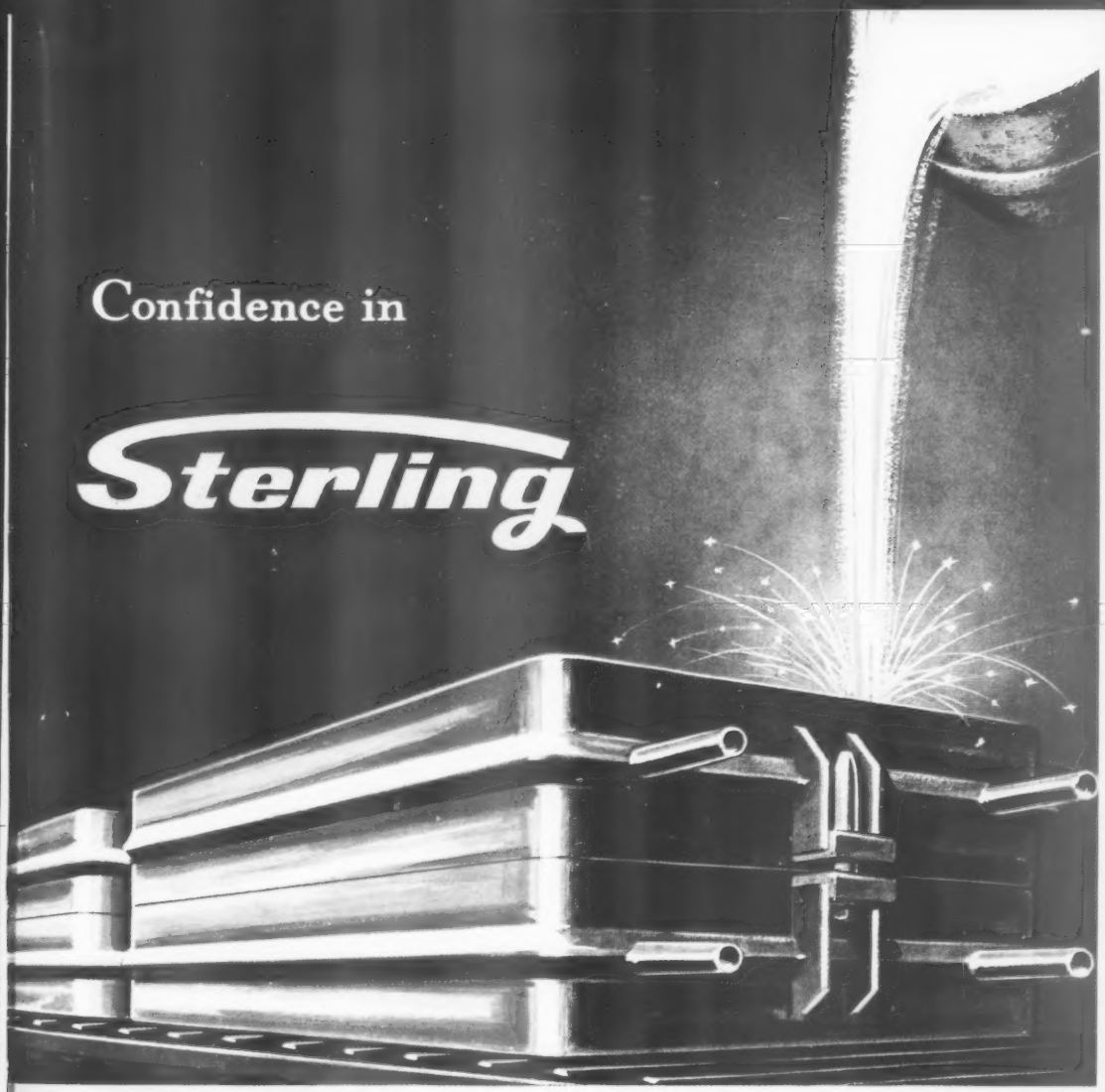

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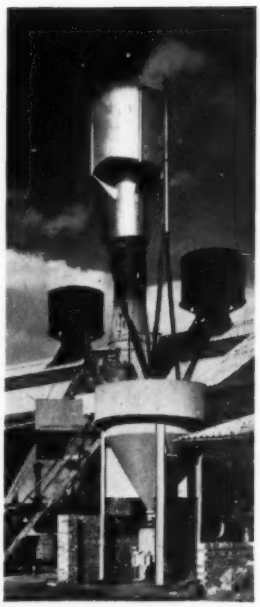

The Filter-Heat water screen grit and spark arrester was operating when the photograph was taken. As you can see against the background of blue sky only steam is escaping.

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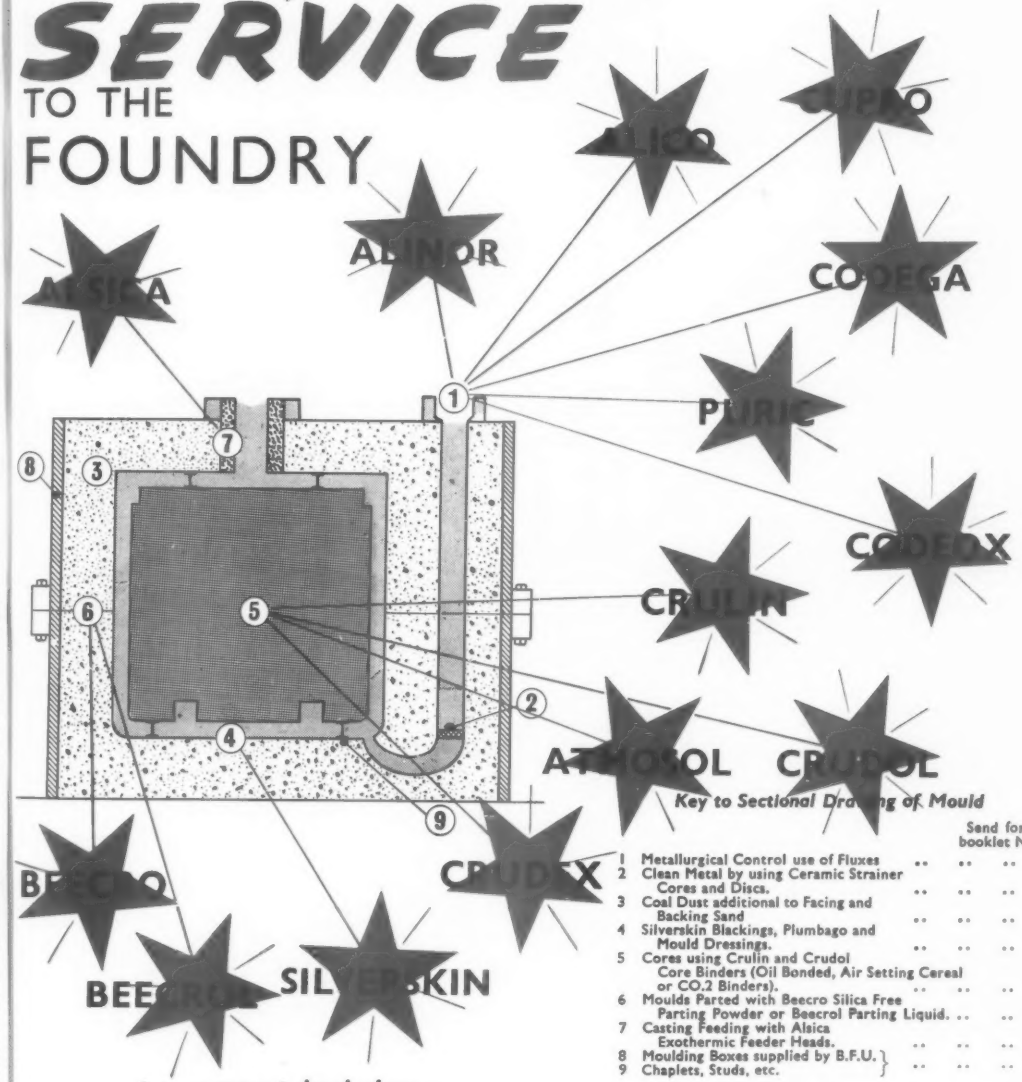

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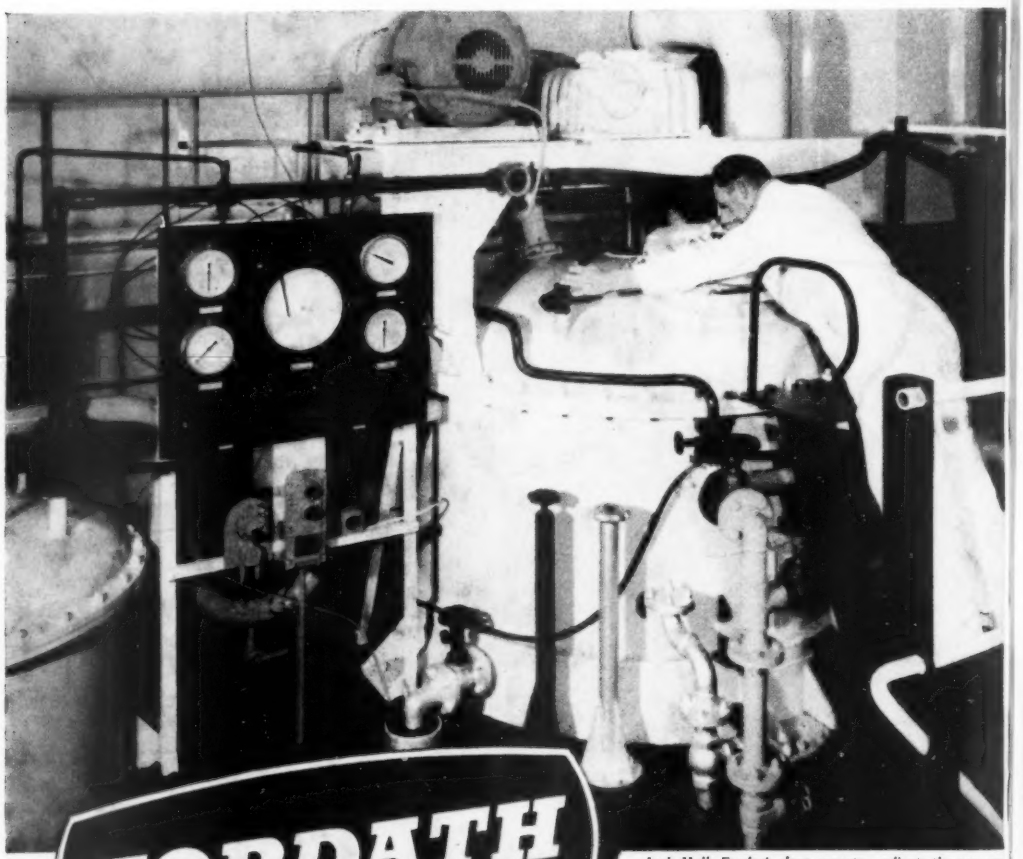

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FOUNDRY TRADE JOURNAL

Vol. 109 December 1, 1960 No. 2295

Established 1902

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IRON & STEEL TRADES JOURNAL

Published each Thursday

Annual subscription: *United Kingdom 52s.*
Abroad 60s. *Payable in advance*

Editorial Director:
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The FOUNDRY TRADE JOURNAL is the official organ of the British Steel Founders' Association; Association of Bronze & Brass Founders; the Light Metal Founders Association; Foundry Trades' Equipment & Supplies Association and the National Society of Master Patternmakers.

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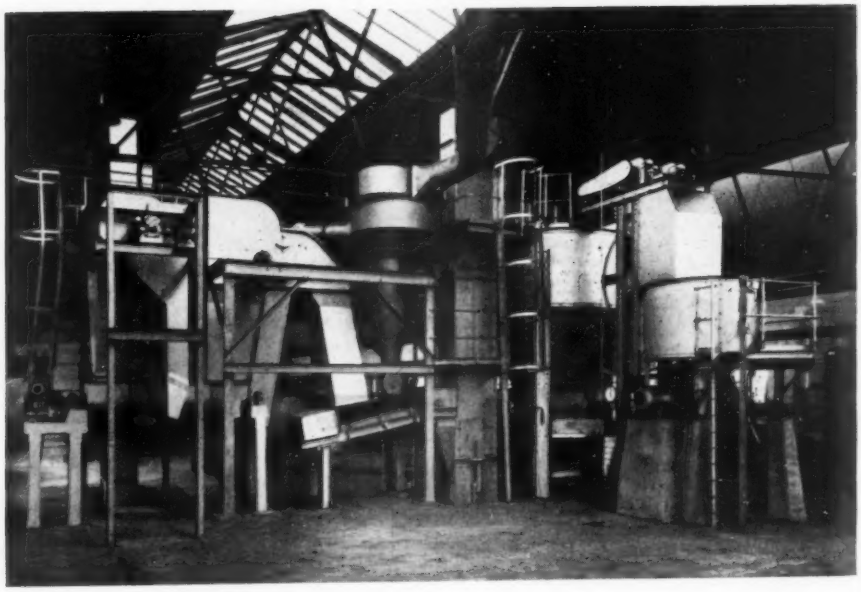

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FOUNDRY
TRADE JOURNAL

Vol. 109 December 1, 1960 No. 2295

Gadgets

Industry, like the handyman, is an addict of the " do-it-yourself " cult and it is almost impossible to visit foundries without seeing useful gadgets which deserve recognition in a wider field. They may be the outcome of a suggestion-box scheme or just developed as a result of informal shop-floor chats to meet an obvious need. The foundry industry is fortunate inasmuch as the main factor which unites the industry is technical development. There is no competition between firms making builders' castings and machine-tool foundries, or between a malleable concern and a magnesium foundry, yet they all develop gadgets which could be capable of benefiting the industry as a whole, and without impairing individual competitive power. The only requirement is greater dissemination of information about these small, but worthwhile developments.

Amongst the gadgets described in the JOURNAL during the last few years are self-emptying moulds for over-metal; a perforated cone for use with a moulding machine to secure even distribution of the sand in the box, and a crucible furnace fume-exhaust system. These are but a sample of useful " do-it-yourself " gadgets whose number is legion and includes rubbish-removal units, cupola-lighting and cognate systems. The British Cast Iron Research Association has given the industry a good lead recently by publishing *Broadsheets* dealing with simple, yet important, operations. The most-recent of these covers the subject of making up botts for cupola tapholes.

Gadgets are of wide importance and we invite the practical men of the industry to send for publication short descriptions of the ones they use. Especially welcome are those from the smaller concerns, as for the larger ones devices and mechanisms for performing even the smallest duties demand the co-operation of the designer—conveyors for over-metal being typical. Some of what were once regarded as gadgets have now become commercialized to the general benefit of the industry. Equipment to put ladle-drying on a rational basis is an example of such a case and moreover such extension to everyday adoption has done no harm to the originator. The publishing of such innovations protects an inventor from any later attempt at Patenting, as prior publication in the Press is quite sufficient to stop the later granting of a Patent to a second party.

BCIRA Activities in Scotland

New Procedure for Dissemination of Results

Recently, as a new venture, the Scottish Committee of the British Cast Iron Research Association (operating from the Scottish laboratories at Blantyre Industrial Estate, Glasgow) has begun a series of periodic reviews of the whole of the Association's work, with the aim of arranging for the better dissemination of the results within the Scottish ironfoundry industry. The committee intends to call open meetings once or twice a year to which all Scottish members are invited to send representatives. At these meetings, members of the Association's staff will speak on some selected topics.

The first of these meetings was held on the afternoon of Wednesday, November 16, at the Central Hotel, Glasgow, at which just over 100 member representatives and Scottish branch members of the Institute of British Foundrymen attended. The theme chosen for the meeting was the recent work on the soundness of iron castings, and the following three short lectures were presented by the Association's staff: "Recent Work of the BCIRA on Problems of Shrinkage and Porosity in Iron Castings," by Mr. I. C. H. Hughes (research manager); "Practical Examples of the Treatment of Shrinkage and Porosity Problems," by Mr. J. M. Greenhill (development department), and "The Problem of Rigidity in Mould Materials," by Mr. D. A. Taylor (sands section).

The excellent attendance and lengthy discussion which followed the lectures proved very gratifying and will no doubt encourage the Committee to pursue the use of this form of open meeting for spreading knowledge of the results of the Association's work among Scottish ironfounders.

Faith in Cast Iron

It was reassuring to learn at a Press conference organized by International Boilers & Radiators, of Gateshead, that over 90 per cent. of their new model of gas/oil-fired domestic boiler—the "Super 45" model—is comprised of castings. The total weight is about 2 cwt., and iron castings are used for the main heating-section, doors and base, and sundry cast valves of non-ferrous metal and tube-fittings of malleable iron make up the total. It is claimed that the heat output of the new model, at 45,000 BTUs per hr., is sufficient for radiators and domestic hot-water for a three- to five-bedroomed house at a cost of little over £1 per week when gas fired and a little under £1 when oil-fired. "Push-button" control from a cast control-panel mounted on the top of the boiler is all that can be seen of the "business end," the rest being enclosed in a "Stelvetite" (fire-resistant plastic covered steel sheet) cabinet. A statement was made by a senior executive of the firm, which is a member of the Booker Brothers, McConnell & Company, Limited, group of companies, to the effect that they would not dream of using anything but cast iron for a boiler of this type as they pinned their faith to this method of construction, based on long experience. Another noteworthy feature of the unit is that no chimney is needed, both incoming air and exit—low temperature—gases passing through a grille in an outside wall of the building.

HEAFIELD INDUSTRIES, LIMITED, Spa Lane, Derby, announce that they have obtained the sole agency in Great Britain for the "Ritex" shin-bone protector, made by Henrich Rohden of Essen.

Forthcoming Events

DECEMBER 5

Institute of British Foundrymen

Sheffield branch:—"Engineering the Re-layout of a Jobbing Coreshop," by A. Atherton, 7 p.m., in the Technical College, Pond Street, Sheffield.

DECEMBER 6

Institute of Production Engineers

Halifax and Huddersfield section:—"Function of Modern Inspection," by A. C. J. Surman, 7.30 p.m., at the Percival Whitley College of Further Education, Francis Street, Halifax.

Combustion Engineering Association

Northern region:—Discussion on the "Coal Price Structure" opened by C. Ramsden, 2.30 p.m., at the Griffin Hotel, Leeds.

Institution of Chemical Engineers

"Study on Electro-precipitator Performance in relation to Particle-size Distribution, Level of Collection Efficiency, and Power Input," by D. O. Heinrich, 5.30 p.m., at the Geological Society, Burlington House, London, W.1.

DECEMBER 7

Manchester Metallurgical Society

"Relationship between Physical Test Results and Engineering Performance," by J. H. Lamble, 6.30 p.m., at the Manchester Literary and Philosophical Society, George Street, Manchester.

Institute of British Foundrymen

Birmingham branch:—"Use of Oxygen in Cupolas and Other Developments," by J. V. Harding, 7.15 p.m., at the Lecture Hall of the Byng Kenrick Suite, College of Technology, Gosta Green.

DECEMBER 8

Institute of Metals

Birmingham local section:—"Beryllium," by J. Williams, 6.30 p.m., at the College of Technology, Gosta Green, Birmingham.

Institute of British Foundrymen

Beds and Herts section:—"Aluminium Castings," by J. Vickers, 7.30 p.m., at the Lecture Room, Town Hall, Luton.

DECEMBER 9

Institute of British Foundrymen

Tees-side branch:—"Consistent Cupola Operation," by J. Jelley, 7.30 p.m., in the Teesdale Hall, Head Wrightson & Company, Limited, Thornaby-on-Tees.

London branch:—Dinner/dance, 7.30 p.m., at the Connaught Rooms, London, W.C.2.

DECEMBER 10

Institute of British Foundrymen

Scottish branch:—"New Developments in the Production of Gunmetal Castings," by F. Hudson, 3 p.m., at the Royal College of Science and Technology, George Street, Glasgow.

Newcastle and district branch:—"Effective Casting through Work Incentive Schemes," by D. E. Austin, 6 p.m., at the Rutherford College of Technology, Northumberland Road.

West Riding of Yorkshire branch:—"Production of Heavy General Engineering and Jobbing Casting using Air-set Cores," by A. Shirley, 6.30 p.m., at the Bradford Institute of Technology.

ACCORDING TO DR. OTTO WILHELM VON TEGELEN writing in the *FBI Review*, West Germany is introducing new laws somewhat similar to the UK Clean Air Act. Industries scheduled for action include foundries. Dr. von Tegelen says "the Federation of German Industries is pressing for tax concessions granted for air-purifying plants to be extended and improved on the grounds that such plants are in the public interest." He adds that the tax concessions (special depreciation allowances) upon which the scheme depends, have not yet been approved by Parliament.

Unusual Stainless-steel Casting*

Although there is diminished opportunity for the exercise of manual craftsmanship on the foundry floor, founders can, and always will be able, to maintain their function of service to the expanding and increasingly varied requirements of their customers only if they are able to offer the abilities of the skilled craftsman where essential.

With the emphasis on the rate of production in foundries, disappointment is often expressed by older foundrymen at the shrinking number of skilled men and the reduction of craft recruitment to the industry. If there is felt to be a loss of individual pride and satisfaction in the bulk of foundrywork, this cannot be lightly shrugged off as the march of progress. It must be acknowledged, however, that much of the "know-how" of the practical foundryman is now dispensed with the slide-rule, the tape-rule, the drawing board and the microscope. These instruments may not produce castings, but they enable others to do so more efficiently, thus strengthening the industry by making its products economical in new and competitive fields. A more balanced appraisal of modern trends might reveal rather a migration of ability to other branches, rather than a dead loss of it to the foundry.

The following is an instance of the making of an unusual casting that a modern production foundry was called upon to furnish, and will be of interest to most foundrymen as illustrating some aspects of basic moulding skill—not unassisted, it will be appreciated, by the fruits of foundry technology.

The casting was to function as the pedestal of a candelabra destined for Exeter Cathedral. Long-term exposure to atmospheric corrosion called for the use of a special steel and a leading foundry in this field was approached for its help. It was decided that both the pedestal and its standard, which was required also, should be produced in an 18/8/3-type stainless steel, offering the necessary degree of long-term resistance.

The Casting

Fig. 1 illustrates the three-dimensional "fresh-air" character of the casting, comprising three legs with feet, and a short stub. All the limbs had slightly-concaved surfaces, carrying a hammered effect which had to be reproduced. The lower parts ("calves") of the legs were bent in a little from the "knees" so that the feet would not rest flat on the ground, but would be lifted at the "heels" from which tendon-like fillets blended into the "calves." No amount of head scratching and aerial manipulation of the "pattern" could manoeuvre it into an as-cast aspect that would permit a clean draw from a mould. The "pattern" was, in fact, the sculptor's wooden model and, as such, could neither be modified nor, of course, dismembered. It was quickly realized that the most suitable combination of mould and drawbacks would have to be sought.

Faithful definition and correct spacial alignment of the limbs was of great importance for aesthetic reasons. It was desired that the finished casting should have a "craftsman" as opposed to a "machine-shop" appearance. To gain the best effect with these factors in mind, it was decided initially to produce the drawbacks as well as mould in facing sand. This, however, did not prove to have sufficient green-strength to withstand the manipulation involved in the production and subsequent handling of the drawbacks. To overcome this problem, a CO_2 mix was used for the drawbacks which could be hand rammed and then

FIG. 1.—*Pedestal casting sparingly fettled to preserve a rugged appearance, more suited to the finish the sculptor required.*

* The casting described was produced at A.P.V.-Paramount, Limited, Crawley, Sussex, founders in stainless steel and non-ferrous metals. Acknowledgment and thanks are made to the directors and management for the use of the photographs and the facilities offered for compiling this account.

FIG. 2.—*Bottom half of the mould, showing the well for accommodation of the drawbacks, from which the general "strategy" of moulding can be seen.*

gassed. Facing sand used in the green state was retained for the mould parts.

The Mould

In general foundry practice, considerations of moulding are usually subordinate to those of feeding. In this instance, fortunately, the nature of the casting afforded considerable latitude to moulding technique in the sense that, although all methods of production were equally difficult, they offered equal opportunity to feed important sections. Feeding could not be disregarded, of course, both on grounds of appearance and because, although functional stresses would be comparatively low, they would not be negligible, and as with the building that would be its eventual home, the casting would be expected to last.

In moulding, it was therefore possible to aim for simplicity, *i.e.*, for the smallest number of drawbacks consistent with the accessibility of the mould for making them *in situ*. The method adopted involved bedding the pattern carefully at the desired angle in the bottom half of the mould, a joint being made that followed the diagonal edges of the stub set below the mould face in a hollow—mated later by a cod in the mould top—and continued along a mouldable contour on the outer top edges of legs to rise in a hump that finished at the tip of the feet. This left three undercut features for which small drawbacks were subsequently made. The third leg descended centrally into the body of the mould (Fig. 2). A well was maintained before the feet of sufficient dimensions to permit the withdrawal of the drawbacks that would fill the volume bounded by the three legs. The moulding of the bottom part at this point was virtually completed except for the production of the drawbacks, but before passing on to describe these, it is important to note that the actual ramming of the drag had to be carried out with great care in view of the fragile nature of the "pattern." The peg and pneumatic rammer had to be used very cautiously when moving-in to the "pattern," and the final working of the sand near to, and surrounding it, could only

FIG. 3.—*In this illustration are shown the eleven drawbacks which not only formed the general internal-shape of the casting, but had also to pick-up the decorative hammered-effect on the concave surfaces of the legs. The success of the casting depended on the snug fit of this "jig-saw" to make one solid volume of sand. To strip the pattern after moulding, the two heavier drawbacks, numbers seven and eight, had first to be extracted—the holes that can be seen in them are for inserting hooks for this purpose.*

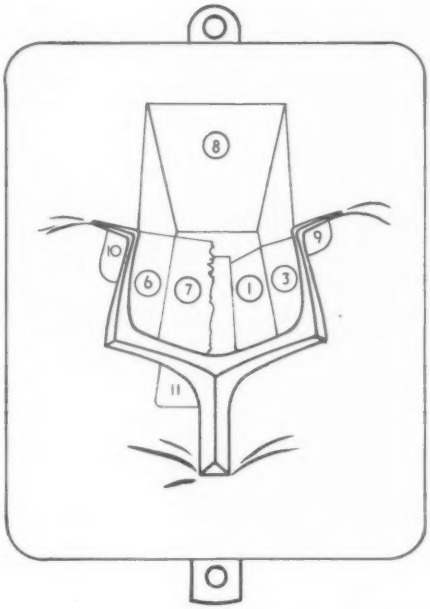

FIG. 4.—*Schematic sketch of the bottom half of the mould, showing two of the lower drawbacks in position.* (1) *lower limb and* (3) *make-up piece. Drawbacks* (6) *and* (7) *(part) of the left-hand upper group and the small external pieces* (9, 10, 11), *together with the deep well to take spacer drawback number* 8 *(not in position) are also shown.*

with safety be carried out by hand—a procedure not conducive to clear definition and dependent on the moulder's "feel" for uniformity in mould strength.

The Drawbacks

Eleven drawbacks were used in all (Fig. 3); seven in the cavity formed by the three limbs, of which five enclosed the concave inner edges, and two acted as spacers to facilitate withdrawal; one in the well,

FIG. 5.—*Mould top with running and feeding system cut. The outline of some of the drawbacks as they "print" into the top can just be discerned.*

also to fulfil the latter function, and three small ones, previously mentioned, on the top of the mould to pick up shallow ribbing. This central block of eight body drawbacks had to act as an integrated mass of rammed sand, and on the close fitting and careful handling of individual drawbacks depended the whole success of the mould. After gassing *in situ*, each drawback was removed and its operative surface treated with a spirit-based resin wash to preserve definition. They were then reassembled in the numerical order indicated in Figs. 3 and 4. The three small surface drawbacks were gummed and pinned in position with cut nails. The difficult moulding problem was now overcome and the final operations, although not without their hazards, were of a less exacting nature.

FIG. 6.—*Mould parts, with the pattern not yet drawn, and the drawbacks spread out, posed prior to closing.*

FIG. 7.—*Pedestal as-cast, with sprue, feeder-heads and flow-offs attached.*

Completion

After firing with spirit-based resin and applying parting powder, the bottom part of the mould was used as the "pattern" for completing the top (Fig. 5). The running and feeding system were located during this operation and completed after opening the mould, removing the drawbacks (Fig. 6), and stripping the pattern. The drawbacks were replaced and closing was quickly followed by the pouring of the mould. The casting was left in the moulding box and knocked-out on the following morning.

The sprue was situated at the end of the stub and open feeding-heads were placed at the two "knees" (Fig. 7). Flow-offs were positioned at the tops of the two upper feet (as-cast) and horseshoe nail denseners at the root of the stub and at the lower (as-cast) "knee." The weight of the casting after fettling was 8½ lb.

In view of the "craftsman" character of the finish required, great care had to be exercised during fettling to restrain fettlers educated in the art of sculpture. As someone aptly remarked, artistry was, in this instance, the prerogative of the customer.

New Patents

(Copies of complete specifications are obtainable from the Patent Office, Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 3s. 6d.)

820,572. E.M.B. Company, Limited, Moor Street, West Bromwich, Staffs.

A method of feeding metal to a die-casting machine of the cold-temperature type. Metal ingots, each of sufficient size to form a single casting, are first passed through a preliminary heater and are subsequently fed singly to a ladle in which the ingot is melted by a high-frequency electric current, the molten metal then being transferred from the ladle to the feed cylinder of the machine.

820,582. British Iron and Steel Research Association, 11, Park Lane, London, W.1.

The duplication of personnel and equipment is stated to be avoided with this invention which relates to the continuous casting of ferrous metals. A single mould designed to cast two or more ingots at a time is used. The continuous casting mould comprises two or more tubular-mould sections each of which is in communication longitudinally with another section. Metal which is poured into one of the sections thus passes into the other sections so that a number of integral ingots are cast together. After casting, the ingots are separated from one another by either a flame cutter, a saw or a rolling mill.

820,654. Sintercast Corporation of America, 134, Woodworth Avenue, Yonkers, 2, New York, USA.

Coated refractory metal-compound comprites, and a method of obtaining an adherent ductile coating upon refractory metal carbide materials. The inventors claim that improved resistance to oxidation, improved resistance to thermal and mechanical impact or shock, and generally improved properties at elevated temperatures, are obtained.

820,689. Plasco, Limited, 155, St. Vincent Street, Glasgow, C.2.

A machine for the production of die-castings, particularly of magnesium die-castings, wherein it is desirable to prevent contact with the atmosphere. This machine has means for automatically providing a continuous feed or replacement of the magnesium to the pot in such a way as to prevent air from contacting the metal in the pot.

821,014. National Lead Company, 111, Broadway, New York, 6, USA.

Improvements in die-casting machines. This invention relates to a loader and holder assembly for locating and holding an insert within a die cavity, so that the insert may be embedded in and held by the finishing casting.

821,112. Shaw Processes, Limited, 14/16, Grey Street, Newcastle-upon-Tyne, 1, Northumberland.

The production of moulds suitable for both ferrous and non-ferrous metal and their alloys. A slurry consisting of alumina, calcium sulphate and an aqueous solution of an alkali metal silicate (preferably potassium silicate) having a specific gravity between 1.05 and 1.2, is poured around a pattern. When the slurry is set by gelling, the pattern is removed without previous drying. The mould piece is then placed in a heated oven until it becomes rigid throughout.

821,317. Polygram Casting Company, Limited, Terminal House, Victoria, London, S.W.1.

A moulded composition for use in the shell-moulding process, in which the thermosetting binding agent comprises a mixture of one or more bituminous substances (*e.g.*, soft coal-tars, soft coal-tar pitches, shale tars and shale-tar pitches, fat tars, and fat-tar pitches), or their constituents, and elemental sulphur. In this company's patent No. **821,611,** methods are claimed of making shell moulds in which it is unnecessary to apply to the pattern more moulding mixture than is required to form the mould. This also obviates the need of turning over the pattern, or of using blowing or other devices for removing excess moulding mixture.

UK Patternmakers Visit to Italy

A party of members of the National Society of Master Patternmakers recently took part in a five-day visit to master-patternmaking establishments and foundries in northern Italy. The visit centred on Milan, but journeys were made also to Turin, Genoa and Pavia.

The programme was arranged by Dr. G. Lo Pinto, secretary of the *Associazione Italiana di Metallurgia*, and started in Milan with a visit to the Museo Nazionele della Scienza e della Tecnica Leonardo da Vinci. This, in addition to many interesting foundry exhibits, has several galleries given over completely to examples of the scientific and mechanical principles discovered by Leonardo da Vinci. After touring the museum, the party were welcomed by Mr. Vincenzo Ventafridda on behalf of a large gathering of representatives of the Italian iron and steel industry.

During the next four days, six master patternshops, three foundries with their associated patternshops and an art foundry were visited. The patternshops included some making only wood patterns, and others producing first-class metal equipment. The latter were very well "tooled" for the job, an interesting feature being the considerable use being made of hand-controlled copy-milling machines. Generally, the shops were very spacious and well kept, and working conditions were of a high standard. One of the foundries visited was a mechanized malleable plant, and here many of the moulding units were of the fully-automatic type. In another, considerable interest was shown in the production of aluminium pressure-die-castings, mainly for automobiles.

The party, which included some of the members' ladies, were entertained by the master patternmakers of Turin, Milan and Genoa. During a dinner given by the mastern patternmakers of

(*continued on page* 695)

The illustrations below show some phases of the visit paid to Italy by members of the National Society of Master Patternmakers. In (a) Mr. E. C. Rowen, president of the Society of Master Patternmakers, is addressing the gathering of British and Italian patternmakers on the occasion of a visit to the General Unione Artigiani—the headquarters of the Employers' Association in Milan; (b) shows Mr. Rowen presenting a case of silver tea- and coffee-spoons to Dr. Lo Pinto and (c) Mr. Vincenzo Ventafridda welcoming the party of British patternmakers at the Science Museum.

Stanton Prizegiving

The Club House at Stanton was packed to capacity for the annual prizegiving on the morning of Saturday, November 19, of the Stanton Ironworks Company, Limited, and its associated companies. Sir Frederick Scopes, chairman of the company (and until recently, managing director) presided; with him on the platform were Sir Robertson King, K.B.E. (chairman of the Electricity Council), the Mayor of Ilkeston, Councillor L. Chambers and the Mayoress, Mr. N. C. Macdiarmid (managing director, Stanton), Capt. C. S. Saunders (director of training, Stewarts & Lloyds), Mr. G. R. Buckley (assistant managing director—works—at Stanton), and Mr. W. S. Matthews, J.P., B.SC. (Stanton's training officer).

The proceedings were opened by Sir Frederick who dealt with education and training matters as viewed by the company in some detail, mentioning as typical of the widespread nature of the activities the fact that employees at the various works were in attendance at no fewer than 14 technical colleges. Prospects for young people in association with the company and the employees' prowess in athletics were also touched upon.

Then followed the presentation of the 42nd annual report on apprentice training by Mr. Matthews. This was quite a lengthy account of work done over the year and included mention of both special and company awards gained by members of the staff of works and offices. Altogether, Mr. Matthews said, 250 apprentices at Stanton had earned awards in addition to 59 at the Holwell Works (plus 12 at Stewarts & Lloyds Minerals), 31 at Cochranes Works, and 17 at the Riddings Works.

After Mr. Matthews had concluded his report, the

Stanton Prizegiving Ceremony: (a) Sir Frederick Scopes (chairman, Stanton Ironworks Company, Limited) addressing the gathering; left to right, the Mayor of Ilkeston (Councillor L. Chambers), Sir Robertson King; (Sir Frederick Scopes); Mr. G. R. Buckley, (Stanton's deputy managing director), and Mr. W. S. Matthews (training officer), (b) Denis Perkins, apprentice moulder, receiving the Scopes Cup from Sir Robertson; (c) Mr. N. C. Macdiarmid (managing director, Stanton) presenting Sir Robertson with a picture to commemorate his visit, and (d) group of Special Award winners.

chairman introduced Sir Robertson King, who was to present the awards, saying that he had always been associated with developments in the area and that his recent award of a Knighthood was fitting testimony to many years' service. Both Sir Robertson and himself could be described as men who had risen from the ranks, the chairman continued, using this to explain to the gathering that the "way to the top" was open to all.

Sir Robertson then commenced the distribution of some of the awards, which are listed below, and afterwards addressed the meeting. He contrasted his boyhood days, when he had literally started at the bottom, with the present-day wealth of opportunity which was open to young people. Current successes of Stanton personnel, he said, should not be regarded as an end in themselves, but as incentives for the future and a spur to continued effort. Closing his remarks, he exhorted his listeners to make sure they also got happiness out of their jobs because a quite large proportion of their waking life was in fact spent in employment.

List of Awards

Notable among special awards announced which were of interest to the foundry industry generally were the presentation of the "Scopes" cup to Denis Perkins (apprentice moulder). It will be remembered that Mr. Perkins was one of this country's team of three who participated in the European Foundry Apprentice Competition this year; this fact was referred to at the prizegiving ceremony and also the fact that this year's award was the third time the Scopes Cup had been won by a moulder. A Foster Prize went to Jack Pittam (apprentice moulder); a Holwell Works Committee Prize (junior) to B. A. Hoggard (apprentice moulder); a Riddings Works Committee Prize to B. H. Hill (apprentice moulder): Foremen's Association Prizes (foundry) to T. H. Reed (apprentice moulder) and (woodwork) K. E. Shortland (apprentice patternmaker); and a Joint Staff Committee Prize to I. Gell (publicity department). Examination results included success in the Institution of British Photographers (intermediate) by D. W. Hatton (publicity department); endorsements to Higher National Certificate in mechanical engineering by E. Marshall (foundry department, Holwell), and J. Bell (foundry department, Cochranes); Ordinary National Certificate—metallurgy, by C. Fowell (laboratory, Cochranes); a final certificate in patternmaking—1st class, to J. Gittus (apprentice patternmaker, Cochranes); an advanced certificate in patternmaking—2nd class by A. Gordon and R. P. Shaw (apprentice patternmakers, Stanton), and an ordinary certificate in foundry practice—2nd class by P. F. Aley (apprentice moulder, Holwell), S. Bland (apprentice moulder, Riddings), M. L. Hurrell (apprentice moulder, Holwell), A. Rogers (apprentice moulder, Stanton), H. Smyth (apprentice moulder, Holwell), and T. Weightman (apprentice patternmaker, Riddings). Token awards were also made by Sir Robertson to about 50 out of the complete list of successful students in the 1960 period who were present in the hall.

For the most part, the young men who presented themselves at the dais to receive awards were impeccably dressed and in this respect provided a most inspiring aspect of well-being in direct contrast to pictures of foundry apprentices years ago. (The sole exceptions to this comment were one or two who had obviously just come off their working shift, but even these were neatly clad in boiler-suits.)

The total value of the awards presented was £2,738—an increase of £92 compared with last year's figure. The total included course and examination fees of £711, awards for satisfactory work of £547 and approved expenses of £1,480. In most cases, the direct awards were of tools, instruments, technical books, etc., which the apprentices could use and treasure for many years.

Next, the chairman introduced the Mayor of Ilkeston to the gathering whom he described as an old Stantonian—out of quite an impressive list of previous employees of the works who had filled that office in the past! The Mayor expressed his appreciation of the ceremony which had taken place and added his congratulations on the way in which the staff and employees co-operated with the local civic authorities in education and training matters.

Vote of Thanks

The vote of thanks to Sir Robertson King and to the Mayor was expressed by Mr. Macdiarmid. During this he also referred to the co-operation which they shared with the local education authority and mentioned, in particular, junior operative courses which had quite recently been established for young employees for whom there were no existing apprenticeship schemes. These, Mr. Macdiarmid said, had proved very successful and it was likely that the scheme would be extended. Finally, the speaker voiced the thanks of the firm and the whole gathering to the training staff for their efforts over the year and to the chairman for his help throughout and for presiding that day. As a parting gift, Mr. Macdiarmid presented a colour picture of a Stanton scene to Sir Robertson and a composite wooden fruit-bowl (made by Stanton apprentices) to Lady King. Sir Frederick Scopes presented a similar bowl also to the Mayoress.

Latest Foundry Statistics

Steel Castings: The October issue of *Monthly Statistics*, a bulletin issued jointly by the Iron and Steel Board and the British Iron and Steel Federation, states that a census taken on September 13 revealed that 18,330 people were engaged in the manufacture of steel castings, that is 410 more than a month earlier—a holiday month. A gain of 980 is shown against the figures for September, 1959. The weekly average production of steel castings during September was estimated at 5,900 tons. Estimated output for the first eight months of 1959 and 1960 was 4,700 tons and 5,500 tons respectively.

Ironfounding: According to the Council of Ironfoundry Associations there was a total of 130,598 people employed in the UK ironfounding industry at the week ending September 3. This represents the considerable increase of 6,589 over the figure for the similar period last year, and of 719 more than on July 30 this year. On October 1, the employment figure had risen to 131,303, the total for the corresponding period last year, being 124,950.

UK Patternmakers Visit to Italy

(*Continued from page 693*)

Milan, a case of silver tea- and coffee-spoons was presented to Dr. and Mrs. Lo Pinto as a memento of the British party's visit.

Excellent arrangements throughout the period were made for the ladies, who were taken on sightseeing tours of Turin and the Italian Lakes. In addition they participated in the general programme for some of the works visits, notably on that to the art foundry, where they found much that was of interest.

Anglo/American Manufacturing Agreement

Under the terms of an agreement drawn up with the Bingham Pump Company of Portland, Oregon, USA, pumps to the American company's design are to be manufactured and marketed by the Foundries Division, Penistone, South Yorkshire, of David Brown Industries, Limited. The pumps concerned are of the double-volute horizontal single-stage centrifugal type and the market will embrace the eastern hemisphere, with the exception of Australia, New Zealand, and part of Japan. The character of the casing which will be cast—in a range of sizes related to users' needs—in carbon steel, chrome steel, or cast iron, as required, to ASTM specification, is illustrated in the right-hand picture below.

Centrifugal pump designers have become aware of an inherent defect in the principle of pumps of single-volute construction, namely, the unbalanced hydraulic pressure in the pump case at all diametrically opposite points around the periphery of the impeller, throughout the pump's operating range. This results in a number of disadvantages affecting the efficiency and durability of the pump. The aim of the double-volute construction is to establish hydraulic radial-balance, thus eliminating deflection of the rotating element. By virtue of this design, hydraulic pressure, acting radially against the impeller at any point, is balanced by an exactly equal pressure acting against the opposite side of the impeller—regardless of head, capacity, or speed at which the pump is operating.

Testing

In order to reproduce the results obtained by the American company, the David Brown division has laid down an exact replica of the Portland test equipment which has been calibrated by the National Physical Laboratory to both British and American standards. The plant, which is shown with a pump in position below on the left, is said to be capable of carrying out performance and suppression tests up to a capacity of 5,000 gall. per min. against a head of 600 lb. per sq. in.

The design of the pump is such that the rotating elements can be replaced on site without disturbing the main pipe-connections. This would enable users to carry spares rather than hold stand-by units.

Sale of Steel Securities

Treasury consent has been given for the Iron and Steel Holding and Realization Agency to sell to the Whitehead Iron & Steel Company, Limited, Newport (Mon), its remaining holding of stock (nominal value £1,050,000) at a price of £80 per £100 of stock, plus accrued interest. The purchase price of £840,000 is to be paid on completion. ISHRA sold the ordinary shares to the company in February, 1955. The redemption of the last securities of Whitehead still held by ISHRA marks the start of the agency's sale of the fixed interest securities of those steel companies which have already been denationalized. The total market value of such securities is about £120,000,000.

The price of £80 per cent. corresponds to a yield to final redemption of the stock (February 1, 1985) of just under 6.1 per cent. Originally £1,250,000 4½ per cent. stock, 1970-85 was issued, but £200,000 has already been redeemed.

The redemption of all this stock for a total of £1,040,000, together with cash receipts of £500,000, and the £3,437,500 for which the ordinary share capital was sold to the public on denationalization, has brought the agency £4,977,500 as proceeds for the disinvesting of Whitehead. This compares with £4,843,447 paid in compensation for Whitehead when the company was originally nationalized

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TWO 121-TON ROLL-HOUSINGS recently left the Darnall works of the Davy & United Engineering Company, Limited, Sheffield, by road for Birkenhead for shipment to Glasgow; thence their journey is to be completed by road to their Scottish destination. The firm is sending 24 housings to Scotland as part of their contract for the 68-in. semi-continuous hot-strip mill for the new Scottish Ravenscraig Works of Colvilles, Limited, and a new temper mill for the company's Scottish Gartcosh Works. Most of the housings will be of 121 tons each, but two later ones will weigh as much as 146 tons.

In the photographs below are shown (left) the test room and test equipment at the David Brown Foundries Division, Penistone, and (right) one of the pump units being assembled for testing.

Equipment & Supplies

Eye and Face-shield

Safety Service Company, Limited, Wendover Road, Harlesden, London, N.W.10, have recently introduced on the market a new type of eye- and face-shield. Known as the "Itex" Monogard, it incorporates a new idea in the form of swivel face-guards, and simply by fitting the appropriate screen (which is 4-in. deep), employees can be protected from flying particles, chemical splashes, gas-welding hazards, etc. The equipment is light in weight and the manufacturers feel that it should have a special appeal because it does away with the "shut-in" feeling common with eye and face protectors.

Eye and face shield developed by Safety Service Company, Limited.

Wood Borer

In contrast to their "Cadet" range of woodworking machines, the latest machine to be released by Thomas Robinson & Son, Limited, of Rochdale, is one of the largest of its type, a multiple-spindle borer capable of the heaviest class of boring in both hard- and soft-woods. The machine, known as the KO/E, can be used for all heavy pattern or corebox work on timber up to 16-in. square section. Basically, the machine comprises a heavy main-frame carrying four independent, vertical boring units, and a fixed or travelling table. A tilting boring unit can be fitted at either or both sides of the machine, for vertical or angular boring. One of the principal features claimed for the machine is that the design of the boring units is such that the machine can be used with equal facility on one-off or repetitive operations. Normally the units are each fitted with a different size of auger, up to 3 in. in diameter and to bore up to 16 in. deep, so that several sizes of holes can be bored consecutively. Each vertical unit has a 7½ h.p. rotor and stator unit driving the splined spindle directly. The tilting boring spindles are each driven directly by a 5 h.p. motor, and tilt up to 30 degrees from the vertical by handwheel. The fixed table which consists of a heavy frame mounted on the baseplate, and having a series of rollers and quick-acting clamps, is normally made to take timbers up to 16-ft. long, but can be made longer to special order.

Lifting Magnets

W. E. Burnand & Son, Limited, Duo Works, 66/106, Shoreham Street, Sheffield, 1, have recently introduced a range of electro-magnets for lifting purposes of "Integral" design, which are at present being offered as an alternative to the firm's "Composite" design, although it is intended that they will eventually supersede the latter. The new type of magnet has a single high-permeability steel casting to form the body, thereby eliminating much precision machining and effecting economies in manufacture, hence, the new type is being offered at a lower price. In addition, the winding consists of a high-conductivity copper coil, insulated with a new form of insulation, and it is claimed by the makers that this gives a much improved performance than the conventional cotton or asbestos insulation. The magnets are vacuum dried and impregnated solid with a bitumen compound before sale, thus preventing the ingress of moisture or its condensation when the magnet cools.

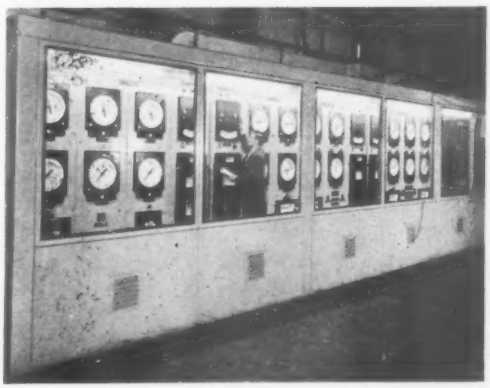
Fork-lift Carriers: Three models of side-operating fork-lift carriers were recently demonstrated at British Railways Carriage and Wagon Works, Swindon. The carriers—manufactured or marketed by Materials Handling Equipment (Great Britain), Limited, 40a, Dover Street, London, W.1—were the "Irion" carrier with a capacity of 6,600 lb. at 24-in. centres, the "Kestrel" carrier of the same capacity, and the Irion "Lizard" battery-operated side-loading reach truck of 30 cwt. capacity.

Brake-bonding Adhesive: CIBA (A.R.L.), Limited, Duxford, Cambridge, announce the addition of Redux 68 to their range of brake-bonding adhesives. This new product has been specially developed for bonding all types of friction materials to operate at bond line temperatures over 350 deg. C. and, it is claimed, it is also capable of filling a gap of up to 0.05 in. between components without appreciable reduction in strength.

Multi-purpose Tool: A multi-purpose tool now available from Bowthorpe Electric Company, Limited, Crawley, Sussex, and made in chrome/vanadium steel, can be used, it is claimed, as a spanner (on nuts up to 2 in.); as a pipe wrench or as a wire-cutter (up to ¼-in. dia.). It is 12-in. long and weighs 2½ lb.

Furnace Control

New instrumentation now automatically controls four furnaces at William Beardmore & Company, Limited, Glasgow. They are two Brayshaw four- and six-zone re-circulating furnaces and two Priest four- and six-zone direct furnaces. The control panel, which is contained in an air-conditioned enclosure, includes Honeywell temperature, combustion and pressure control, with Kent flow-metering. Installation and commissioning of the panel was carried out by Honeywell Controls, Limited.



Notes from the Branches

Birmingham

As already reported briefly in these columns, the Birmingham branch of the Institute of British Foundrymen acted as hosts to a party of 26 Belgian foundrymen who came to this country in October for visits to a number of foundries and research laboratories in the Midlands. The arrangements had been made over the three previous months with Mr. Alex Pirson, secretary of the *Association Technique de Fonderie de Belgique*.

The party arrived on the morning of October 26 at Elmdon Airport, Birmingham, where they were met by the Birmingham branch president, Mr. M. M. Hallett, and the branch secretary. They then proceeded to Alvechurch, to the laboratories of the British Cast Iron Research Association where, before touring the establishment, they were entertained to luncheon by the Association. The director of BCIRA and staff acted as guides for the visitors. After returning to their hotel in Birmingham, a few of the Belgians attended in the evening the branch lecture given by Mr. A. A. Timmins on "Work-study in the Foundry."

On the following morning, the party was shown around the laboratories of the Mond Nickel Company, Limited, Wiggin Street, Birmingham, where they met various members of the staff. The company also provided an excellent luncheon at the Queen's Hotel, Birmingham. In the afternoon, the visitors split up into two parties and went their separate ways to William Mills & Company, Limited (Wednesbury), (aluminium-alloy founders), and F. H. Lloyd & Company, Limited, Darlaston (steelfounders and engineers). Great interest was shown by the parties and it was only regretted that more time was not available to see more of these extensive works.

On the evening of October 27, the Belgian party were the guests of the Institute at a dinner, presided over by the branch president, supported by 15 members of the branch Council. Representatives of the companies and laboratories visited included Mr. H. Morrogh (BCIRA), Mr. Dixon (Mond Nickel Company, Limited), Mr. D. Griffiths (William Mills & Company, Limited), Mr. Page (Chamberlin Hill & Company, Limited) and Mr. H. G. Hall (Castings, Limited).

Mr. Hallett eloquently addressed the guests in their native tongue, saying how honoured the branch was in having the opportunity to entertain them, and that he thought the visit would further the already good relations between foundrymen in both countries. In his reply (in English) Mr. Paul de Keyser, of Fabrimetal, said how much the Belgians had enjoyed their visit and thanked the Institute for their assistance and hospitality.

On the last day (Friday, October 28), visits were paid to the mechanized and malleable iron foundry of Castings, Limited, Brownhills, and the foundry of Chamberlin & Hill, Limited, Lichfield (see Figs. 1 and 2). After luncheon at the George Hotel, Lichfield, by invitation of the two firms visited, the visitors departed from Elmdon Airport in the late afternoon.

East Anglian Section

Members and guests of the East Anglian section met for the first meeting of the 1960/61 session at their new venue, the Ipswich Civic College, the proceedings being under the chairmanship of Mr. T. D. Oughton. In a short address to the assembly, Mr. Oughton extended his thanks on behalf of the section to Mr. Metcalf and staff of the Civic College for their help and co-operation in securing the accommodation, and added that early in 1961, when the college was fully operational, it was hoped that the new lecture hall would be available for meetings of the section. He went on to say that the students and visits would always be welcome at the lectures, and it was hoped that those with foundry interests and qualifications would in time become members of the Institute for, to keep the section virile, new blood was constantly needed. Mr. Oughton who is now serving his second year of a two-term presidency, concluded by saying that his first year as president had given him great pleasure and he was looking forward to his second term of office.

The chairman then introduced Mr. F. G. Hayes, education and training officer for the Council of Ironfoundry Associations, who was the lecturer for that evening, his subject being "Changing Foundry Techniques and their Impact on Manpower Requirements." Mr. Hayes dealt with the modern approach to training in the foundry. Apprentices showing initiative and adaptability should, he said, be urged to continue their training at suitable training centres since, for economical reasons, facilities for craft training were not to be found in small foundries. Most of the technicians would eventually come from the colleges and the craftsmen from training centres where craft, not skill in writing, was the requirement. The speaker aptly answered the numerous questions put to him in the discussion which followed. The meeting closed with a vote of thanks, proposed by Mr. Garrick, which was carried with acclamation.

Lancashire

The inaugural meeting of the 1960-61 session of the Lancashire branch was held at the Midland Hotel, Manchester, on Saturday, October 8, when the new branch president, Mr. F. W. Nield, in his presidential address called for a more unorthodox approach to research problems in the foundry industry in order to meet future foreign competition.

He then called upon Mr. W. D. Ford, A.M.I.MECH.E., to read his paper entitled the "Foundry Foreman's Influence on Maintenance." Mr. Ford explained that he was works manager of a foundry producing 400 tons of tractor castings, cylinder-heads and -blocks per week, and he stressed the importance of good housekeeping, cleanliness, and the regular systematic maintenance of plant, with special reference to the responsibilities of the foreman. He said compressed air was the life blood of the average foundry and advised the use of electric grinders, and hoists, etc., to relieve demand on air supplies. He said he favoured the duplication of essential components of plant wherever possible but there were severe practical limitations and duplication was not the complete answer to maintenance problems. A vote of thanks was ably proposed by Mr. Kirkham, seconded by Mr. Lawson, and carried with acclamation.

Discussion

In the discussion which followed Mr. Ford's paper, MR. C. M. G. WALLWORK asked (1) What was the economic maintenance factor; (2) would the lecturer define responsibility of foundry foremen and maintenance staff in respect of shop cleaning, and (3) what were the mechanics of administering a maintenance staff.

MR. FORD said that it was difficult to give a firm figure in answer to the first question because some people he had spoken to included, for example, boiler-house staff in their maintenance where others did not.

Similarly the much larger maintenance staff required in a highly-mechanized shop was obviously likely to cost more than that required in a foundry which was not so highly mechanized. However, the figure he worked on was approximately 4 per cent., being a percentage of maintenance costs over estimated sales.

In reply to the second question, Mr. Ford said the amount of "janitoring" for which the foundry foreman was responsible was limited to the foundry floor and pits. That is to say that due to previous troubles in getting machinery cleaned regularly the lecturer had provided the maintenance department with three night-shift cleaners who were paid by the foundry as previously, but who now worked under the maintenance department. These men saw to it that conveyor belts and other machinery were kept reasonably clear of sand.

So far as the last part of the question was concerned, the normal relationship existed from the foundry engineer down through his foreman millwright and electrician to the maintenance men themselves. This system seemed to work perfectly satisfactorily and in most cases the foundry engineer would take up his problems with the foundry superintendents being on the same level, but if a helping hand was required then any difficulty would be reported to the works manager who, being an engineer himself, would give the complaint very sympathetic attention.

Scrapers

MR. LAWSON mentioned that his company had the problem of continually renewing sand-mill scrapers—could Mr. Ford help him on this?

MR. FORD said that he assumed the scrapers referred to were in batch mixers and whilst he had experimented with Stellite tips and depositing hard weld metal on the scrapers, if water was put into the mill

FIG. 1 (*right*).—*Group of Belgians with one of their hosts (Mr. H. P. Taylor, works manager) at their centre, watching the pouring of shell moulds at the Lichfield foundry of Chamberlin & Hill, Limited. Fig.* 2 *shows the visitors assembled outside the works. Mr. Taylor is again shown at the centre of the front row, with Mr. M. M. Hallett,* M.SC., F.I.M., *managing director of Chamberlin & Hill, on his left and Mr. P. de Keyser, who headed the Belgian party, on his right.*

Notes from the Branches

before the sand, wear would be greatly reduced.

MR. HAYNES remarked he was pleased to see on the slides shown that cast-iron plates made an ideal foundry floor. He asked if trouble from hot sand on rubber conveyor belts had been experienced and had the author used mohair belts.

MR. FORD said he had no experience of mohair belts at all, but burning of rubber belts had been a trouble to him in the past and had been successfully overcome by having a ¼-in. thick layer of woven asbestos cloth vulcanized into the top surface of the rubber belt. He agreed that cast-iron plates made an ideal floor and pointed out the advantage of having a reserve of iron of correct composition all over the floor if ever supplies ran short. MR. HAYNES said he had replaced rubber belts with mohair with great success.

MR. WILLIAMS asked if Mr. Ford would give his opinion on duplicating equipment so as to guard against breakdown.

MR. FORD replied that he considered it essential to carry replacements for certain important items such as mould-conveyor gearboxes, sandslinger heads, also a spare conveyor belt equal to the length of the longest belt in use and so on. He pointed out that there was obviously an economic limit beyond which one could not reasonably go, otherwise it would be necessary to build a second foundry side by side with the one in use so that everything could be duplicated. He did say that if four pairs of moulding machines were in continuous use then it was highly desirable to have five pairs, so that regular maintenance could be done during ordinary working hours, quite apart from the value of the spare pair of machines in facilitating pattern changing and thus reducing down time. Apart from that the stores should keep a comprehensive stock of small parts which are known to need frequent replacement for the whole range of equipment.

Sand Spillage

MR. HENDRY said sand spillage from conveyor belts was a source of trouble. Had Mr. Ford any views on this and had he had experience of totally-enclosed conveyor belts?

MR. FORD said that the only totally-enclosed conveyor belts he knew were the ones which were enclosed for the purpose of fume exhaust and he thought that this was not what Mr. Hendry really meant. However, the width of belts used was most important to spillage and he had, as a matter of fact, recently installed some 24-in. conveyor belts where the equipment suppliers had suggested 18-in. This had been done in order to reduce spillage and was, he thought, a success and the extra expense easily justified.

MR. HAYNES asked why all the fume-exhaust piping was overhead and not in tunnels under the floor. MR. FORD agreed that ducting below floor level was preferable to carrying it overhead, but of course, was very much more expensive and was not always convenient to do where the ducting was put in after the plant had been running for some time. These were the reasons for not carrying it out in this foundry.

MR. PARKER referring to the wear on sand-mill ploughs asked if a correct mix was obtained when water was added first.

MR. FORD replied that their procedure had been to put the water in first then add the sand followed by bond and coal-dust and perfectly satisfactory results had been obtained.

Maintenance Schedule

MR. TOLLEY said he had used enclosed conveyors with doors to admit air, but cleaning was a great problem and he had considerable difficulty in getting the management to see the necessity of regular maintenance.

MR. FORD said that on his enclosed conveyors hinged sides were fitted for inspection and cleaning purposes but not to admit air. Regarding maintenance he advocated a maintenance schedule of any form, however simple, which provided for a regular check of certain sections of the plant by the same men at regular periods. He said that oiling and greasing schedules were most important for regular lubrication and a good deal of help could be obtained from the oil companies, who would survey a plant and put forward a recommended lubrication schedule. In his own foundry he had a nightshift inspector whose job it was to examine wire ropes and inspect the plant continuously, reporting all defects back to the foreman millwright. A simple card-index system, with one card for each month of the year on which regular annual examinations for replacements were detailed, was employed to ensure completion of the jobs known to require regular service.

MR. TOLLEY spoke of the defects that arose when faults were not notified by the production people to the maintenance department immediately they occurred.

MR. FORD agreed that the reporting back of trouble was a very difficult problem to overcome, but he said that in his opinion it was essential for the maintenance department to go out and look for trouble rather than wait until it arose, and that if they could not rely on the production staff reporting defects, then systematic inspection and close liaison was the only possible solution.

Wear of Sand Mills

MR. HARPER referring to wear in sand mills said that he knew of foundries where plumbago was added to each mix in order to obviate this trouble and the results were excellent.

MR. FORD said that he was very interested to hear this suggestion but it was likely to be a rather expensive business and wondered just what percentage of plumbago was used.

A member referring to Mr. Ford's system of a nightshift plant inspector asked how many shifts were worked on production.

MR. FORD replied that the foundries at Wellingborough were only working on dayshift apart from a small amount of coremaking carried out at night.

MR. LAWSON asked if Mr. Ford had any help to give them regarding maintenance of water pipes to cupola spark-arresters.

MR. FORD said that so far at Wellingborough they had no spark arresters fitted to their cupolas although these were being arranged and would be fitted in the near future, but because of his lack of experience he was unable to give any real help.

IBF London Branch Dinner/Dance

Members are reminded that the annual dinner/dance of the London branch of the Institute of British Foundrymen is to be held on December 9 at the Connaught Rooms, London, W.C.2. A number of tickets are still available and those wishing to attend are asked to get into touch immediately with Mr. W. R. Buxton, Eyre Smelting Company, Limited, Tandem Works, Merton Abbey, London, S.W.19.

SECTION DEVOTED TO THE TECHNOLOGY OF PRODUCING DIMENSIONALLY-ACCURATE CASTINGS

BICTA Annual Conference*

Discussion of Papers presented

In this issue of the JOURNAL is reported the discussion that took place during the first two sessions of the second annual conference of the British Investment Casters' Technical Association held earlier this year at the Connaught Rooms, London. The two papers discussed have been printed already in the JOURNAL (see relevant footnotes). The film "Multiple-dip Shell Process," was also shown at the second session and the ensuing exchange of ideas between the delegates will be of great interest to readers generally (in addition to investment casters).

The first Conference session, under the chairmanship of MR. L. S. TAYLOR (G. L. Willan, Limited) was devoted to the presentation and discussion of a paper entitled the "Metallurgy of 13-per-cent. Chromium Steel Castings"† by Mr. J. Beech.

Opening the discussion, MR. D. C. JARMAN (De Havilland Engine Company, Limited) said that as a producer of investment castings he welcomed the news that metallurgists were now investigating the problems associated with the 13-per-cent. chromium group of steels. With regard to the last paragraph, under the heading "Steelmaking and Casting Conditions," he asked Mr. Beech whether the superior properties obtained on castings produced under a partial vacuum referred to the ductility and impact properties and, if so, whether this was to the detriment of the ultimate tensile strength and, possibly, proof stress. The aim was for 50 to 60 tons u.t.s., and all the figures he had seen had been in the 30 to 40 tons u.t.s. range. He expressed the desire to know whether improved elongation and impact properties could be achieved at the higher u.t.s. With regard to the Author's reference to the formation of oxide films, Mr. Jarman commented that this had never been a problem at his works, and he wondered whether the phenomenon was possibly oxidized porosity as, under vacuum conditions, it was found that the porosity increased considerably until success was achieved in improving gating the feeding techniques. He asked if the Author could give more details of the effect of nitrogen, and also indicate the optimum nitrogen level on this type of steel. In conclusion he said he would like to mention an article which was not specifically on castings, but on the types of chromium steel under discussion. Its title, "How to Avoid Trouble," had attracted him from the beginning because he had always been in trouble! The Author in this instance had made it clear that the alloy he was discussing had been introduced to the United States from England. He then enumerated all the problems and attempted to solve them but, after several pages, he had concluded his article by saying, "There you have it, this steel is barely producible, barely machineable and barely heat-treatable," after which it could be then asked that if this were true why did one try and cast it.

MR. J. BEECH replied, stating that the point about tensile strengths was a very good one. The improvement made by vacuum melting referred to impact properties, which rose from 20 to 30 ft.-lb. (air-melted), to 100 ft.-lb. (vacuum-melted). This rise was, in fact, at the expense of tensile strength. The oxide films referred to were seen in large sand castings. He added that he would not like to state a nitrogen level and assumed that nitrogen would cause much trouble in chromium steels—but could offer no further help.

MR. A. DUNLOP (Wilkins Campbell & Company, Limited‡) expressed particular interest in Mr. Jarman's reference to the effect of vacuum in reducing gas porosity, and its indirect effect on feeding. Many years ago, he stated, the British Non-Ferrous Metals Research Association carried out a considerable volume of work on gas removal in bronze and found that, then when they produced a gas-free bronze, it proved very difficult to produce pressure-tight castings without introducing a controlled amount of gas into the gas-free metal. Probably, with the use of a damp mould this would arise automatically. The volume change which takes place when metal changes from liquid to solid must be compensated for by feeding, otherwise shrinkage occurs. If a small amount of gas is present, the shrinkage could be dispersed in a harmless way, but remove the gas and more-localized massive shrinkage might follow, with detrimental effects on mechanical properties.

Impact Properties

MR. L. S. TAYLOR then remarked that from bitter personal experience, he had found that low ductility and poor impact properties were not necessarily associated with the presence of delta-ferrite.

MR. J. BEECH replied that, recently, he had been told that it was not necessary to vacuum melt, provided there was the right distribution of delta-

* Second Annual conference of the British Investment Casters' Association.
† Printed in the JOURNAL, November 3, p. 569.
‡ Now with Jessop-Saville, Limited.

BICTA Discussion

ferrite. He added that that was probably an old-fashioned idea nowadays. He agreed that some variable other than delta-ferrite was involved; however, low impact-properties had been obtained where the delta-ferrite occurred in the network formation. This could have been coincident with the high gas content or the high "residuals" content, but in the main, he felt in agreement with the chairman's comment.

MR. A. G. MASON (Deritend Precision Castings, Limited) asked Mr. Beech whether he was aware of any difference in the level of impact-properties obtainable by melting in high-vacuum as opposed to vacuum-melting stock in reduced pressure of the order of one or two millimetres.

MR. J. BEECH stated that the results quoted as having given better impact properties under vacuum were only under pressure of the order of one or two millimetres. However, he hoped to find out whether higher vacuum has any effect.

THE CHAIRMAN recounted that when he had to cope with this problem of low impact on 13 per cent. chrome steels, affected material was remelted in vacuum, in the hope that ductility and impact figures could be improved, but very little was achieved. Conversely, vacuum-melted stock when remelted in air again gave poor results—as could be seen from figures given in other papers presented; this rather implying that the actual melting caused the trouble.

MR. A. C. DEACON (Birmingham Small Arms Company, Limited) suggested that the specification for some of the high chromium steels, particularly S.80, was rather wide particularly with reference to the carbon content, and asked Mr. Beech for the ideal carbon content to aim for, to obtain the maximum impact properties and ultimate tensile strength, and also for a form of standardized heat-treatment, particularly as there had been some very involved heat treatment, with this material, including sub-zero treatments.

Replying, MR. J. BEECH said that the choice of carbon content was not an easy one since other factors must be considered besides impact properties. For example, a lower carbon content, about 0.15 per cent., would give better impact properties, whilst a higher carbon would make heat-treatment easier. Corrosion resistance would also be adversely affected by a high-carbon level. In most cases he did not think that complicated heat-treatments were necessary. With a structure free from delta-ferrite, a straightforward hardening-and-tempering should be sufficient.

MR. DEACON then asked what hardness could be expected with a 0.15 per cent. carbon content following a normal heat-treatment, and what impact and hardness or tensile after tempering.

MR. J. BEECH said that a hardness of about 210 B.H.N., after tempering, should give about 45 tons per sq. in. in u.t.s.

MR. D. H. FARRIMOND (H. & F. Precise Castings, Limited) recalled that many years ago he had been associated with efforts to manufacture the turbine wheel for the cartridge starter unit in 13 per cent. chromium steel. He stated that enormous difficulties had been experienced and, that to be quite honest, a successful one had never really been made. The casting comprised a heavy boss in the centre, with the turbine buckets spaced around the periphery of the wheel. The two problems consisted in maintaining sufficient heat to run the fine edges of the turbine buckets, whilst pouring at as low a temperature as possible to obtain soundness in the boss. The job had been passed on to a European investment casting company and, as far as the speaker was aware, they had made a success of it. Mr. Farrimond continued that in reply to Mr. Deacon's question about carbon, he thought it was well worthwhile mentioning that his company had had some steel made up in this country to a Continental specification and from which they had produced quite successful castings. The specification was given as follows:—C 0.18 to 0.23 per cent., S 0.5 to 0.7 per cent., Mn 0.9 to 1.1 per cent., Co 1.9 to 2.1 per cent., Mo 0.7 to 0.9 per cent., Va 0.25 to 0.35 per cent., and Cr 12.0 to 12.5 per cent. The heat treatment used by the Continental company had been of the multiple-cycling type and had consisted of preheating to 700 deg. C. for an hour, and then raising the temperature to 1,100 deg. C., followed by quenching using an air-blast, if necessary, depending on the size of the casting. This had been followed by further preheat at 700 deg. C., and an elevation to 1,050 deg. C., followed by an oil-quench at 150 deg. C. Finally, it had been tempered at 630 deg. C., for two hr. and air-cooled, with a final operation at 150 deg. C., and a stress-relief for two hours. The speaker said he was unable to give any elongation figures, but quoted 54 to 57 tons per sq. in. yield point and 66 to 73 tons per sq. in. u.t.s. The elongation at room temperature had been about 10 per cent. He rounded off his comments by inviting Mr. Beech to give his views on the pitting problem.

Pitting

MR. J. BEECH regretted that he had done no work on pitting and the only work that he had seen of a fairly comprehensive nature had been that carried out by Mr. Jarman and Mr. Duffen, who were present. He suggested that they might like to enlighten the audience.

MR. D. C. JARMAN felt that not much more information than had already been published by them could be given. Their main contention had been that pitting occurs on solidification or afterwards. Having a vacuum furnace, he said that they were fortunate in being able to investigate this defect and were producing castings completely free from pitting, by excluding air and oxygen at the point of solidification and until the castings were down to about 500 deg. C. They had their production problems and what they now needed was some comparatively cheap equipment, such as a cheap pumping-device, and chamber.

MR. A. C. DEACON presumed that when Mr. Jarman excluded oxygen from the casting, it would

have been by vacuum; he raised the question of whether that meant that it was not possible to avoid pitting without using a vacuum at all.

Mr. D. C. JARMAN replied in the affirmative and added that the problem was to exclude air very quickly from the interface of the mould and the metal. Purging with nitrogen or argon or with another gas would not do this quickly enough, because although it resulted in an improvement, it was never completely possible to eliminate pitting. A vacuum, which evacuated the mould in a few seconds, was the answer. A good pump was needed, to evacuate the mould very quickly, then—often with nitrogen or argon—it is purged under a reasonable pressure of gas, but oxygen has to be excluded.

The CHAIRMAN stated that in discussions in the metal specification committee, the concensus of opinion had been that pitting was always related to the presence of atmospheric oxygen. The avoidance of pitting depended upon the efficiency of the method used to remove atmospheric oxygen. A vacuum was one way of doing it; but if it were possible to create a reducing atmosphere, *e.g.*, as in the case of inadequate wax burn-out, then a considerable amount of CO would be evolved at the metal interface, which would overcome fusion. This was not a recommended way of overcoming the problem, but it was a question of what was the best and the cheapest way of having an oxygen-free atmosphere.

MR. JARMAN added that part of the work to be carried out by BSCRA, would be concerned with pitting and that they would appreciate comments from the industry on how this problem should be approached.

Why 13 per cent. Chromium?

MR. A. C. DEACON asserted that the answer to Mr. Jarman's question, "Why do we use the blankety-blank alloy?" had not been given. He asked whether it was because of good tensile strength and corrosion resistance, and that if this were so, then these mechanical properties could be obtained with austenitic steel with some additional hardening. It might be dearer, but at the price these castings were sold, he did not think that it would matter much. If on the other hand it was the low coefficients of expansion that were the attraction, he asked whether it would not be possible to use an 18/8, which was easy to cast, with all the properties required and no "spotted dick."

In reply MR. J. BEECH contended that Mr. Deacon had provided the answer himself by saying that the chrome alloy was the least expensive one to use.

MR. A. C. DEACON answered that with the scrap experienced it was really a very expensive alloy.

MR. J. BEECH developed his reply by saying that in the larger casting industry when a corrosion resisting alloy was needed, then 13 per cent. chromium was the limit for good corrosion resistance. So one decided on 13 per cent. chromium and then tried to solve a set of problems. There were many other alloys, *e.g.*, the new American one, C.D.M.Cu 4. This was not 18/8, but about 25 per cent. chromium, 4 per cent. nickel and some molybdenum, and had good corrosion resistance. He asked whether there were any problems with those alloys too, stating that as he did not make investment castings, perhaps he could ask some of the investment casters present why they did use certain alloys.

MR. A. E. THORNTON (Firth-Vickers Stainless Steels, Limited) opened his statement by congratulating the Author upon the amount of detailed work involved in reviewing the conclusions of so many authorities and condensing them within the confines of the paper. He confessed, however, to a feeling of confusion and in some measure, disappointment. The sense of confusion, he said, must, of necessity, arise from the fact that the line of demarcation between references relating to cast structures on the one hand, and hot-worked structures on the other, was by no means clear. There were many factors arising in the metallurgy of cast structures in this type of alloy which might not be applicable to forged structures and vice versa. Consequently, one must be careful not to confuse the issue.

The sense of disappointment arose, he asserted, from the fact that the paper did not contain more direct comment on the views expressed by the authorities quoted and consequently, in the absence of those primarily concerned, one felt somewhat restricted in discussion.

Mention was, however, made in the paper that 13 per cent. chrome steel for castings was becoming increasingly popular. The discussion that morning would suggest that from the technical point of view, its popularity was in some doubt. It might perhaps be useful to bear in mind that this particular composition was the original stainless steel discovered by the late Mr. Harry Brearley about 1913 and the first castings were produced nearly 40 years ago. During the course of industrial development, many limitations had been found, both from the point of view of metallurgical properties and process control. Consequently, throughout the years, there had been seen the development of the austenitic stainless steels and later, the duplex steels. There were undoubtedly, he went on, certain applications where the 13 per cent. chrome steel still gave satisfactory service, but this field was relatively small and there were many applications where, at one time, this material had held the field, but which by reason of greater service stresses or corrosive conditions, it had been progressively superseded by alternative compositions.

So far as the question of hardness was concerned, like all other steels, it softened on tempering. By and large, tempering (after hardening) to a temperature of 500 deg. C. made little impression on the hardness value, but between 500 and 700 deg. C., there was a steep fall from approximately 400 to a little over 200 Brinell. If the Author proposed to embark on a research project relating to the

effect of carbides upon the properties of the material, work associated with the tempering range might prove interesting.

The Author referred on page two of his paper to certain concern in regard to scatter in impact results and implied that this feature was difficult to control. If, as one assumed, the comment referred to conventional sand castings, it was hardly correct and could not pass unchallenged. Impact tests on this type of foundry production could be controlled and, indeed, have been controlled, but in order to control them, it was necessary to understand the basic fundamentals of the metallurgy of this particular alloy. As to the importance of the impact test, Mr. Thornton said that he could only remember offhand, one particular contract where an impact test had been called for, but that was by the way.

Delta Ferrite

In discussing the general ductility of this material, however, the effect of delta ferrite and nature of the carbides were important, and he referred the Author to the Symposium published by the Institute of British Foundrymen in 1950. This publication contained typical microstructures of all the castable alloys in which members were interested and contained typical microstructures of the 13 per cent. chrome steel, together with associated mechanical properties. He thought that it would be agreed that in these examples, there was little or no trace of delta ferrite. One was a little confused, he went on, by the question raised by the Author concerning the stability of delta ferrite and certain references in Para. 4 of the summary seemed to be somewhat contradictory. If, as the Author implied, delta ferrite was amenable to heat-treatment, one would certainly be interested to have further details.

The speaker expressed interest in Mr. Jarman's remarks about the thorny subject of "spotted dick." To his mind, there was no doubt that it was associated with oxides in some form or other. The Author had suggested that it was due to an iron/silica reaction. This question was certainly a most important one and on reading the paper, the speaker made an investment casting in mild steel under conditions where the trouble could be expected to be demonstrated. The resultant casting (handed round) showed no trace of "spotted dick." The trouble was, however, very prevalent on many high-chrome steel-compositions and one could not help but feel that chrome oxide had the major influence on this type of pitting. Very probably when cast in vacuum, the formation of oxide would be prevented, resulting in a casting skin free from pitting.

In conclusion the speaker came back to Mr. Dunlop's question "Why cast it?", and asked that as there were far better steels available to the investment founder which did not give "spotted dick," why run the risk of trouble when it could be avoided by other means.

In reply MR. J. BEECH thanked Mr. Thornton both for his pointed remarks and for some very useful comments. As far as the increasing popularity of 13 per cent. chrome steels is concerned, he was afraid, there was, as Mr. Thornton had pointed out, some confusion whether cast or rolled alloys were under consideration. The increasing popularity referred to larger castings. Possibly, as a fall-off in trade developed one firm wanted a casting they had not made before, and was prepared to make it in 13 per cent. chrome steel; hence, it was thought that they were becoming increasingly popular. The point about the tempering range was interesting and would be borne in mind. The ferrite referred to in his paper was very stable and difficult, if not impossible, to break down.

MR. P. A. CROOKE (Samuel Osborn & Company, Limited) then asked how far one could draw an analogy between the 13 per cent. chrome steels and the 17/4 precipitation hardening materials. He understood that it was an integral part of the structure of the 17 per cent. chromium precipitation-hardening steel that there should be over 5 per cent. free ferrite and, possibly, up to 20 per cent. as part of the mechanism of controlling the transformation range of the martensite and to make heat treatment a practical proposition. He said he also understood that the inclusion of free ferrite in the structure was not considered detrimental in the case of cast precipitation-hardening stainless steels, because they received no later deformation or hot working, which could cause the formation of phase and consequent embrittlement.

Mr. J. Beech regretted having no experience of that type of alloy, but commented that obviously some ferrite was needed for the precipitation hardening.

Pitting

MR. WILSON (Trucast, Limited) asked Mr. Jarman about pitting. He stated that some attempts had been made at his works with a micro-fusion product, which contained roughly about 40 per cent silica and 25 per cent. chrome, and manganese and silicon. He wondered whether Mr. Jarman had found that the 0.5 level affected pitting, and also whether he had investigated the problem of removing the silica and using some alternative. The speaker then asked Mr Beech whether he had any experience with the addition of boron to 13 per cent. chromium alloys. He had used the CD4 MCU alloy to a small extent in experiments and had found it to be a very good casting alloy, but he had never obtained more than 64 tons u.t.s.

MR. D. C. JARMAN replied that the question related to lowering manganese and increasing silicon, and added that it had been done on several of the alloys and whilst it reduced the degree of pitting, it did not eliminate it. However, it was not so bad as when the manganese/silicon ratio was in the opposite direction. Here again, he had tried most of the alternative dipcoats—alumina/zircon, etc.—which also reduce pitting, but do not eliminate it. His works, he said, had had "spotted dick" with all types of dipcoats. He added that much time and money had been spent in sub-

stituting the cheap and easy silica dip-coat used for several years, but it was reverted to because pitting could not be got rid of completely. Many of the thin section castings always caused trouble and the silica coat was reverted to with the exclusion of oxygen. With reference to Mr. Thornton's comments, he said that if the paper were read, it would be seen that the Authors did not profess to know completely the mechanism, and that he would not argue about the presence or absence of chrome oxide. There was no pitting, in that sense, on the mild steel casting, but the contention was that there was an overall pitting effect on mild steel, which some were of the opinion was virtually the same mechanism.

MR. R. A. MONTGOMERY (Fairey Aviation, Limited) said that it was claimed that by freezing 13 per cent. chrome steel, having controlled the chromium and carbon content, within certain limits, it was possible to obtain a 90- to 100-ton tensile level, with a ductility of 16 to 18 per cent. He wondered whether Mr. Beech had done any work in this direction and whether he had any figures to substantiate this claim.

Mr. J. Beech replied that he had no experience of the freezing of 13 per cent. chrome steel.

MR. R. A. MONTGOMERY added that he referred to freezing at minus 70 deg. C. after hardening but MR. J. BEECH had no comment to make.

Ferrite Again

MR. A. DUNLOP commented on Mr. Cooke's point about the retention of a certain amount of ferrite in the austenitic castings of the 25/12 type. Mr. Thornton, he said, had done a large amount of work on this type of steel, and the retention, in the as-cast structure, of a small amount of ferrite does affect the distribution of the carbide. Without the ferrite being there, small amounts of carbon could produce enough carbide to give a complete network, but the presence of a certain amount of ferrite in the as-cast structure seemed to localize the carbide into pools, with a corresponding increase in ductility. Mr. Thornton's company had investigated welding rod composition and had come to the same conclusion that, to get crack free welds, the welding rod should contain a certain amount of free ferrite. At one time, when his foundry was casting nozzle guide-vanes in these alloys it had a specification, within the DTD specification, to include free ferrite in the as-cast structure, and one of the standard tests had been a magnetic test to ensure a certain amount of magnetism in the as-cast material.

MR. A. E. THORNTON asked whether there was not some confusion of steels there, as it was not austenitic steel. With regard to the point about the amount of delta ferrite in austenitic steel, his colleagues had done a large amount of work on this subject and it was perfectly true that there must be a certain amount of delta ferrite. From many points of view, it was essentially a problem of fabrication and must be kept distinct from casting. It went right through the industry, not only with regard to investment castings.

MR. A. SCHOFIELD (De Havilland Engine Company, Limited) stated that for over six months he had been seeking after a full explanation and he was still seeking. At the time when he had met Mr. Beech, he had blamed everything on to the presence of delta ferrite, and had said that the low impact-values in his materials were due to this large amount—about 13 per cent. of delta ferrite. He thought he had learnt a lot since then and would not like to make that statement to-day. But he would say that they had been plagued by the difficulty of regularly obtaining good Izod values. If they could only get 10 to 15 ft.-lb. and adhere to it, they would not mind setting the specification at 10, but their normal achievement was well below the floor level referred to by Mr. Beech. They had been working on this for some considerable time and 5 or 6 ft.-lb. was commonly obtained. Furthermore, they had not succeeded in removing delta ferrite once it was present. It seemed to him that the presence or absence of delta ferrite was essentially one of balance in composition. With 13 to 20 per cent. and also with only 4 per cent. of delta ferrite, their impact values were still 5 and 6 ft.-lb. This was not to say that the ductility was also poor; they would obtain 14, 16, and 17 per cent. elongation in these materials, and a level of 40 tons proof and 50 to 60 tons u.t.s. They were satisfied with these figures, and while they were not paying too much attention to impact values, they nevertheless could not let them go unnoticed, and he wondered whether they were perhaps below the transformation temperature of this kind of material when getting 5 or 6 pounds. If they were to repeat their tests at a higher temperature, say, 150 deg. C., he wondered whether they might not obtain much higher impact values.

Choice of Applications

Mr. Schofield added that he would like to say a word about the question of why that steel was being used. In their case, they wanted a steel of 50 or 60 tons tensile strength which was weldable to a sheet material. It had been chosen so that they could weld it to a sheet material—that was the reason why they were using the steel, and why they found their choice so limited. They had asked themselves many times why they did not use a precipitating hardening steel, but at that moment they were committed to the use of the 13 per cent. chromium steel. Incidentally, he added, although 13 per cent. chromium steel was spoken of, he wished to ask what exactly was meant by this material. The chromium content could apparently vary from 11 to about 20 per cent. if one included S80, but he took it that one thought of all these steels as being in the same class.

He wondered why when making a steel which was essentially martensitic one wished to harden it, rather than just tempering it. They had obtained good properties with S.80 by tempering alone, but could not do this with the more complicated steels containing, in addition to 11 or 12 per cent. chromium, 1 or 2 per cent. nickel, some

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molybdenum, and vanadium. It had been suggested that delta ferrite would become oxidized if the casting was cooled very slowly from the liquid state. They had some evidence that that might be partially true, but it did not appear to alter the impact value.

He concluded by saying that another contention was that you could not eliminate delta ferrite once it was present. However, if one heated at 1,150 deg. C. or above it was of interest to note that its contours became less sharply defined.

MR. J. BEECH stated that with regard to the effect of delta ferrite on the transition temperature, a short while ago in Sheffield he had spoken to a co-worker and apparently delta ferrite, according to this person's experience, did raise the temperature quite a bit. Reverting to the results obtained by Napiers the ferrite had been in small pools and the vacuum treated steel had given good properties, whereas the steel that had not been so treated, had given poor properties. Again, they did not quite know exactly what was involved. As regards Mr. Thornton's remark that his statement about variable impact properties had not been quite true as applied to sand castings, that was according to his experience, but some BSCRA members had experienced very wide scatter in their impact values.

MR. A. E. THORNTON remarked that he had said that he did no want it to go out from the Association that it was a steel where the impact properties could not be controlled; experience had proved that they could be controlled, provided the fundamentals were properly understood by those producing it.

MR. D. H. ARMITAGE (P.I. Castings (Altrincham), Limited) said that the occasion arose in every conference when he had to use the term centrifugal casting. With a centrifugal casting, technique under established control, and a silica mould, they did not get "pitting" with 13 per cent. chromium steel. There was no simple answer to the problem, and all the reasons put forward were probably contributory factors.

MR. H. J. MEERKAMP VAN EMBDEN (N.V. Philips' Gloeilampenfabrieken) said that the answer to the question why founders were casting 13 per cent. chromium steel, was that the customer asked for it. He stated that his company had met and overcome the same difficulties, at least in part, by adding some molybdenum.

Written Contribution

The following written contribution was made by Mr. L. W. Duffen and Mr. D. C. Jarman (De Havilland Engine Company, Limited) as a clarification of views they had expressed earlier:—The writers were fairly certain that the pitting occurs *after* solidification, and could be avoided completely by not allowing oxygen to come into contact with the mould/metal interface after solidification, until a specified temperature (not exactly known) was reached. They were fairly certain that the casting conditions, atmosphere, melting furnace, etc., had no effect on the pitting, what was important being what happens after casting, *i.e.*, after solidification. They were not certain of the exact mechanism involved. Mr. Gwynn had said that with centrifugal casting this form of pitting did not occur, and it was possible that it was either the unusually dense mould or the absence of pre-coat which was responsible for the absence of pitting and not the effect of centrifuging.

MR. J. BEECH in reply said that the points raised by Mr. Duffen and Mr. Jarman with regard to the absence of "spotted-dick" in centrifugal castings were of much interest. It was quite possible that both the pre-coating and mould density could affect slag reactions. It would seem that the effect of these two factors could easily be tested by using centrifugal type moulds (*i.e.*, corresponding density and without pre-coating) and casting them static. Since oxygen had been shown to play a major part in the production of the defect, the effect of oxygen should not be disregarded when considering its absence in centrifugal castings.

SECOND SESSION

The programme for the second conference session—when Mr. N. Walker (Hadfields, Limited) occupied the chair—comprised the presentation and discussion of a paper entitled "Specifications for the Investment Casting Industry in the U.K."* by L. S. Taylor (G. L. Willan, Limited) and A. G. Mason (Deritend Precision Castings, Limited), followed by showing and discussion of a film on the "Multiple-dip Shell Process," by Mr. K. W. Thompson (K. W. Thompson Tool Company, New York).

Testing

MR. D. H. FARRIMOND (H & F Precise Castings, Limited), opened the discussion by asking if Mr. Mason could clarify whether it was necessary to carry out a mechanical chemical analysis of the melt for each customer or whether one chemical analysis would satisfy any number of customers receiving castings from that melt. Under "Freedom from Defects," the specification stated: "In the event of any casting showing metallurgical defects during subsequent manufacturing operation, such casting shall be deemed not to comply with the requirements of the British Standard." Everyone tried to make good castings, and perhaps 95 per cent. of the time they did, but unless the customer had asked for an X-ray examination and dye-penetrant testing, then he would from time to time receive castings which show microporosity and subcutaneous blowholes—defects which were not visible to the naked eye by means of ordinary visual inspection. Castings despatched with these defects did not show any inefficiency on the part of the foundry, it was just unfortunate that a few had gone through. But this was probably going to produce friction between the customer and the

* Printed in the JOURNAL, August 4, p. 147.

foundry if the customer took a rather intolerant attitude on receiving such castings. Hence, the section referred to was worthy of some further consideration and possibly revision.

With regard to mechanical testing, the clause stated clearly that mechanical properties should be estimated on each batch of heat-treated castings, and the Authors of the paper had stated that one full set of tests per heat treatment batch should be supplied, from which one might infer that it was possible to reduce the amount of work involved by loading a pile of castings into the furnace, and calling it one heat-treatment batch. However, BS 3146 stated clearly that test bars could be cast separately to test the quality of the metal from which the castings had been poured. He asked why had they not succeeded in getting this point accepted. It was his opinion that each batch of metal received from the steelmaker could be tested by casting it in test bars, carrying out mechanical tests, and then saying, "That batch of metal is O.K. and any castings made from it, provided there is a chemical analysis, will be satisfactory." The chemical composition did not radically change apart from the carbon content, the checking of this being a minor operation. Since test bars could be legitimately cast separately, he would have thought that to carry out a series of tests on the incoming batch of steel would have been quite adequate. The material of the higher alloy types, and cobalt alloys, which presented analysis difficulties, might be considered under Part II to be satisfactory, if tested by the supplier. Thus one was agreeing to that method of testing. Moreover, laboratory personnel, and equipment had to be kept down to an economic level, otherwise the price of the castings would be higher still.

In the Authors' closing remarks regarding the higher alloys, they referred to the chemical analysis and mechanical testing, which involve lengthy processes. They are extremely precise, but in mechanical testing the room temperature properties did not mean a great deal in many cases. Since the pattern had already been set in Part I, any modification would be difficult to achieve, and it would probably be even more difficult in respect of Part II.

MR. A. G. MASON did not think that, as the clause governing chemical analysis stood, there was any reason to suppose that an analysis would have to be carried out to satisfy each customer. He went on to say that it was up to the supplier of the castings to satisfy himself—as, after all, his own integrity was at stake to a large extent, and he had to satisfy himself that the analysis was representative of castings supplied. He could see no objection whatever, as the clause stood, to carrying out one analysis and using it for any number of customers interested in the analysis.

With regard to the clause relating to freedom from defects shown on machining, it must be remembered that the British standard specification was really a safeguard to the customer and that customers were represented on the British Standards Institution Committee in larger numbers than BICTA was. He did not know whether it was entirely justified, but that was the reason for this clause.

In the case of mechanical testing, Mr. Mason continued, it was suggested that one batch of mechanical tests could, perhaps, be carried out for each incoming cast, however large. While it ought to be agreed that the mechanical test, when carried out, represented the quality of the metal from which the casting was made, rather than the casting itself, it ought also to be agreed that it was a measure of control of the heat-treatment operation. The inclusion of the requirements, whereby one set of tests should be carried out per heat-treatment batch, was as loose as could be justifiably expected. The same comment was, perhaps, pertinent in some respects to the super alloy type of materials, inasmuch as a large proportion of these castings might well be supplied in the as-cast condition in some of the alloys under development. This being the case, the question of the heat-treatment batch just did not apply. Thus, a test on an incoming batch of material would then cover the matter quite adequately. He asked whether that answered the question.

Stretching

MR. D. H. FARRIMOND replied in the affirmative and added that when making castings to rather close dimensions, problems associated with stretching following distortion from the heat-treatment had to be dealt with; the problem was one of restoring correct shape under adverse conditions. The buyer had that problem as well, but there were enough problems in making castings, apart from their heat treatment. He said he would always confine the heat treatment to annealing; certainly, he did not like the idea of hardening and tempering—it was the thin edge of the wedge—before the nitriding, case hardening and so forth were carried out.

MR. A. G. MASON sympathized with this viewpoint, but pointed out that it must be recognized that if work was to be done to the BSI specification, there was no way of avoiding heat treatment. Without this, the properties called for in a large number of cases could not be obtained. That being the case, this clause had to be inserted to show not only that the quality of the metal was satisfactory but that the heat treatment operation had been carried out satisfactorily.

MR. D. R. WOOD (Mond Nickel Company, Limited) said that on page 6 of this paper mention was made of the need for a new test bar, with particular reference to impact properties, because those testing procedures taken over from the wrought alloys were not suitable. His company's laboratory, he stated, had been concerned with the super alloys of various kinds and the work it had been conducting now for several years concerned suitable test bars for measuring tensile properties and high-temperature creep properties. It had been mentioned in the paper that it was a good idea for metal suppliers to carry out suitable tests of stock material, and that that was accepted and

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would be done, where appropriate. Ultimately, foundries supplying high-temperature alloy castings for long-term service under stress and high temperature, would have to satisfy themselves that they were achieving the required properties in their castings.

He stated that his colleagues, R. M. Cook and P. J. Penrice, had been responsible for this work and were hoping to present a paper* at the forthcoming European Investment Casters' Conference. They would not give cut and dried answers, but would show how the field had been explored.

Explanatory Leaflet

MR. P. G. CHAPMAN (P.I. Castings (Altrincham), Limited) said that their job was to make and sell investment castings, and looking at this new specification it seemed to him that they had a very valuable tool which could assist them in their sales efforts. It was known that BS. 3146, Part I, existed, but did potential customers know it, he asked. Several aspects of Mr. Mason's paper needed to be brought to the attention of potential customers, and perhaps an explanatory leaflet might be issued by BICTA to cover some of these points. For example, the subject of non-directional properties in castings had been discussed fully in the paper. Also, the fact had been mentioned that, when this specification had been prepared, not only had the investment casting industry been fully represented, but also the user industry. He felt that some document to be read by the user, in conjunction with Part I, would be a useful way of securing publicity for investment castings and of introducing BS.3146, Part II.

MR. A. G. MASON warmly supported Mr. Chapman's remarks. It was not sufficient, he said, to bring pressure to bear on the BSI to prepare a suitable specification, but that specification must be made known to all concerned. The idea of issuing an explanatory leaflet by BICTA was particularly good. This could be quite a simple outline of some of the more controversial points, so as to put designers fully in the picture regarding the meaning of the specification.

The CHAIRMAN said that when he had mentioned that morning the proposal to prepare leaflets for publicity purposes by the Technical Publicity Committee, he had reported that they had discussed this matter and that, at a later stage, and in co-operation with Mr. Taylor, as chairman of the Metal Specification Committee, it was hoped to present this information to the best advantage.

Test Bars

MR. A. DUNLOP (Wilkins, Campbell & Company, Limited) referred to the fact that Mr. Mason had mentioned in his last remark that they should put before the designers the meaning of the specification. It did not necessarily follow that the test bar figures were the figures likely to be obtained in the casting and he looked upon test bars as an indication of quality of material tested and not as the quality of the casting tested. The design of the casting might be such that it was extremely difficult to produce a completely sound casting and, of course, the art of test bar making was to produce a sound test bar. However, he concluded, it was not as easy to produce a sound casting, so the designer must not be misled into expecting in the casting the properties he obtained in the test bar.

MR. A. G. MASON agreed that it was correct to say that the mechanical properties of test bars were not those obtained in castings, a point which was made quite clear in the specification.

MR. N. MASON (Firth-Vickers Stainless Steels, Limited) felt that the test conditions as stipulated in the specification had been laid down before the figures could be obtained. In many cases they were now trying to get the figures, as with the 13 per cent. chrome steels, whereas the specification had been already drawn up. The significance of the figures obtained and laid down in the specification was surely one of control, and they had to make their customers understand that the control of the founder was such that they were obtaining the optimum figures. The test bars might have significance, but without that, as Mr. Dunlop had said, you could have a reputation for producing first-class test figures, but when the casting was machined, blowholes would be found and it would be rejected, as laid down in another phrase of the specification.

MR. A. G. MASON said that the previous speaker's first comment was that the properties stipulated in the specification had been written in before they knew they could obtain them. He did not think that that was entirely true. They had collected and analysed this information and wherever they had found reason to disagree with the proposed properties, generally speaking by analogy with existing specifications, they had opposed them, and modified some of the requirements. He did not think they could regard any of the properties called for in Part I of BS. 3146 as unrealistic.

MR. I. L. GWYNN (P.I. Castings (Altrincham), Limited) thought it would be opportune to ask the chairman to put the question to the floor as to how successful BS. 3146 had been. Speaking for his own company, they had had their first enquiry within the previous two or three weeks for one of these specifications and he believed that this specification had been in existence for about six months.

The CHAIRMAN replied that Mr. Gwynn was asking him to ask how successfully this BS. specification had been publicised. He could not help feeling that, for some considerable time, customers would continue to order castings according to the conditions they had been used to in the past—they might even continue to do so in spite of the specification. There were many applications which did not demand the calling for of castings to this specification. Whether or not some of the delegates might have felt that it was a bad thing to publicise this specification, he did not know; there certainly had been quite an expression of opinion against it for some considerable time.

MR. A. G. MASON said that the question of

* See JOURNAL, September 1, page 273.

publicity for this new specification had already been raised and he thought that the responsibility lay fairly and squarely with the manufacturers; obviously, designers had to be educated in respect of any new specifications, and it was up to members, when they received enquiries, to put the designers on to the right lines with respect to the specifications available.

Test Figures

MR. D. H. FARRIMOND asked whether Mr. Mason could give them any idea of the number of results reported to him from his appraisal of mechanical test figures from members of BICTA—how many of those results had been obtained from the standard test pieces and how many from sub-standard test pieces. Secondly, it was rather important that they should know the basis for carrying out these tests. Had the Committee considered, he queried, issuing any recommendations as to the type of test piece assembly for estimating mechanical test properties.

MR. A. G. MASON replied that the results already analysed that had been submitted to the BICTA Committee had been taken irrespective of the size of the test piece. With the exception of the impact test piece, which is governed by existing British standards, most of the test pieces had been sub-standard, but they had not taken the difference in the size of test piece into consideration. They had bunched all the results together, and they could see from the comparatively good distributions which had been obtained on these curves, that there was, in most cases, no obvious external variable operating. Thus, they would expect that the size of test pieces was not affecting the results.

He continued that as far as the second question was concerned, whether the BICTA Committee had considered recommending the type of test piece assembly which should be used, that was probably outside the existing terms of reference. However, he thought that it would be advisable to extend the terms of reference to include that type of subject.

Errors

MR. G. LYON (Fairey Aviation, Limited) referring to the diagrams said that there had been one peculiarity which Mr. Mason must have spotted on the CLA 1C steel, where the yield stress was the same as the u.t.s. One of the main difficulties of the Authors must have been the variation in heat treatment from one source of information to another. The chart for the carbon steel for which the mean maximum tensile stress was 43 tons and those for some of the higher alloys, which must have been heat treated, showed a wide variation in properties between the last few at the higher and those at the lower end of the range. He asked Mr. Mason to say how variations in heat-treatment had been dealt with.

With regard to Table I, Mr. Lyon continued, it appeared that the remarkably good results had not been obtained by investment casting, but with sand-moulded castings. In nearly all cases they were as high as was obtainable in wrought alloys in the direction of grain flow. He quoted the case of 0.20 per cent. carbon steel, when the wrought material was given an elongation of 29 per cent. maximum, with 16 per cent. at 90 deg. to the direction of rolling. The casting was shown as giving 30 per cent. elongation. It rather seemed that these must have been abnormal results, because their own tests, which had been very interesting on this point, had been that in the cast specimen elongation had been dead in the middle between the longitudinal and transverse wrought bar specimens. This they believed to be correct. If higher elongation were obtained than in wrought steel surely it should be considered whether the conditions were really representative.

MR. A. G. MASON apologized to Mr. Lyon for not having drawn attention, as he had intended, to the error in Fig. 1 in respect of the distribution curve in u.t.s. The figures obtained on yield strength had been printed below the maximum tensile stress curve and should have read: mean value, 43 ton per sq. in.; standard deviation, 3.7 ton per sq. in. A large amount of arithmetical work had to be done in that investigation, and a number of curves had been produced apart from those that had been presented in the paper. The curves presented had been considered suitable to illustrate the points they had wanted to bring out. They had not had time yet to analyse these results with regard to the variation in heat treatment, so that the distribution curves had been based on results obtained whatever means had been used.

With respect to heat-treatment, he went on, as far as the mechanical properties in Table I were concerned, these were not results obtained from investment castings, as had been suggested, they were results from conventionally moulded steel castings, and he could not vouch for them as they stood. He thought, however, that the elongation values mentioned represented the exception, rather than the rule. On glancing down the column, it was more true to say that the elongation value obtained from the cast steel fell between the two wrought values. However, he could not offer any further comment on those results.

MR. W. N. JONES (Deritend Precision Castings, Limited) suggested that as there were users who would call for tests for many years to come, the value of some standardization in investment castings' specifications was very great indeed and he wondered whether Mr. Mason could give them his views on a certain amount of standardization on normal alloys for commercial purposes, where tests, or certificates of analysis, would not ordinarily be called for.

Committee Background

MR. A. G. MASON replied that when the BICTA Committee was first formed, the BSI Committee had been, of course, already under way, so they had considered in that Committee that it was pointless to dublicate the work of the BSI by producing standards to control high quality castings; hence,

they had considered the alternative, *i.e.*, to let the BSI produce the specifications to cover these high quality castings, while BICTA concentrated on producing a set of—for want of a better term—alloy identities, which could be used on commercial castings where the standards were not quite so exacting. After a great deal of discussion, it had been thought that it would not be advisable if the only technical association in the country which represented the interests of investment casting was to put forward a series of alloy identities for low grade castings only. With this in mind, it was rather difficult to compile a national standardization scheme for these commercial alloys. He thought that at that moment, the existing system, under which each individual foundry had its own commercial alloy identities should be adhered to.

"Heavy Weather"

MR. A. E. THORNTON (Firth Vickers Stainless Steels, Limited) asked whether they were not making rather heavy weather of the question of specifications. They had to approach the matter in a realistic way and decide among themselves for what purpose the specification was required. He noticed that the Authors referred, in particular, to the steel castings for use in air-frames. He thought that if they were considering the question of investment castings for air-frames and air-engine applications, they should bear in mind that these operate under conditions which were very different from those arising in the normal hurly-burly of commerce. He could not recollect one commercial enquiry or order that had been lost over a period of several years because no standard specification had been available, and he was thinking especially of the type of materials referred to in Part II of the series of specifications. The demand and the development of investment castings for airframe and similar high-duty applications would, in all probability, come from the user's side, and they must realize, in the main the lead would be given by the appropriate design section, who would have full knowledge of the stresses and peculiar conditions under which a particular investment casting was to work. Apart, therefore, from the essential metallurgical characteristics of the material, the method of testing was of great importance. It appeared that in that particular field, the industry itself was not decided upon the type of test piece which would provide the degree of control which the user demanded and which was essential. It had been suggested that tests might be taken on the original bar stock, but in his opinion, for *that particular application* such a procedure could be most misleading. The ideal was reached when the test piece figures were directly related to figures from cut-up tests. The metal specification committee would, he felt, give better service to the industry if they first of all very carefully considered the form of test piece that could be cheaply produced and which was a direct indication of the properties of the casting which was to be supplied. In that way, the reputation of the industry would grow and the development of precision castings would be expanded. Until that time was reached, the industry would be well advised to take full advantage of the user specifications and not to proceed to impose upon, or allow to be imposed upon the industry, standard specifications which could only have a restricted application and might lead to difficulties which would not serve the user in the way they felt he should be served.

MR. A. G. MASON stated that the users of investment castings were represented on the B.S.I. Committee, and they could give the greatest assistance to B.S.I. in producing the type of specification which was going to occur in Part II of BS. 3146. The highly alloyed steels had been produced in the greatest volume by the users who had so far produced their own specifications. Now these users were co-operating with the B.S.I. Committee and were giving valuable guidance—more guidance, in fact, than the smaller independent foundries were generally able to give. The result of this should be, therefore, that the specifications ultimately included in Part II would adequately cover the requirements of the users. He said that reference had again been made by Mr. Thornton to the type of test piece and he had suggested that the BICTA Committee should give guidance as to the type of test piece which was most suited to the process. Again, he said he could only say that he hoped that the terms of reference of the Metal Specification Committee would be extended to cover this subject. This contribution concluded the discussion on Mr. L. S. Taylor and Mr. A. G. Mason's paper.

Multiple-dip Shell Process

The CHAIRMAN announced that the second contribution in the session was to be provided by Mr. Thompson of the K. W. Thompson Tool Company of New York, who had made a film in his foundry, which had not been shown previously, on the application of the multiple-dip shell process.

MR. K. W. THOMPSON (K. W. Thompson Tool Company, New York) then took the opportunity of thanking members present for the wonderful hospitality being shown to him and his party while in this country, and looked forward to an opportunity to reciprocate.

After Mr. Thompson had shown his film, the CHAIRMAN asked Mr. Dunlop to open the discussion.

MR. A. DUNLOP began by saying that there were many advantages in the shell technique, first of all the important one of costs. Mention had been made that day of the cost of carrying out tests; here, then was a method of reducing the cost of the whole process. In this country, in days gone by, when the industry had been very much tied to aircraft work, costs had probably been of secondary importance, but things had changed since, and the shell technique would enable the investment caster to make inroads into many other fields. Mr.

Thompson had mentioned the possibility of mechanization; that was being done to some extent, but with simple, hand-operated equipment, the output could be very good indeed. He asked for details of the wire Mr. Thompson hung the mould on. It had appeared to get very hot and the shell had been very hot, had it been a heat-resistant wire, he queried.

Mr. K. W. THOMPSON answered that it had been just plain baling wire. It was hanging there so that when the wax melted, the rod could fall out.

Tolerances

MR. MARSHALL (Ply Cast Process, Paris) stated that in one of their plants in Western Europe they were producing 100 moulds a day with the shell process, and they were concerned with sewing machine components made to close tolerances. He had, therefore, carried out a study of tolerance dispersion. Had Mr. Thompson made any study of such factors?

MR. K. W. THOMPSON said that the tolerance they still claimed, as they always had under the old solid-mould technique, was ± 0.005 in. per in., with reservations depending on the size, the shape, the metal alloy, and so forth. They had gone as low as ± 0.001 in. per in., but they tried not to.

MR. MARSHALL expressed particular interest in the point relating to very close tolerances. They had sewing-machine parts with bosses and sewing machine feet 3-mm. apart. They had used the Austenal process, on 60,000 pieces, with something like ± 0.02-mm. But in a very specific operation, with air-conditioned wax investment everything went swimmingly, but with the Ply Cast process, they had not yet been able to come to that fine tolerance, and had been forced to push it up to 0.03 mm. He wondered, in Mr. Thompson's case, if he had sufficient time to look at tolerances, and how far he went.

MR. K. W. THOMPSON replied that they could go about as far with the shell technique as they could with the old solid mould. As a rule they found that tolerances vary more because of the pattern, rather than because of the metal, or the shell. In other words, with very good moulds one could do better. Most of the deviation was in the wax, rather than in the finished casting.

MR. H. J. MEERKAMP VAN EMBDEN (Philips' Gloeilampenfabrieken) asked whether the wax which was melted out was reclaimed or rejected.

MR. K. W. THOMPSON answered that it was reclaimed, but added that frankly, they did not do much with it, as it was not too good. It could be used for runners, but not to any great extent.

Mr. H. J. MEERKAMP VAN EMBDEN'S second question concerned the binder and suspension that the speaker was making. When he had a stabilized suspension, then it dripped off faster, and he supposed they had an unstabilized suspension and presumed he could not use silica sand which was very apt to become stabilized.

MR. K. W. THOMPSON concurred, adding that it must not be let to dry too fast. That was where the art came in, just how much dripped off; the trick was to let it drip as much as possible and still keep as much as possible of the slurry on it. In that connection, he added, one must aim at a compromise—with too thick a coat, one did not achieve the permeability, and if it was too thin, it was likely to crack. On some of the smaller castings they had seen, it was necessary to get a fairly thin shell. Again, they had to use small "trees," because the smaller the tree, the thinner the shell could be. If they had made a tree three times the size, they would have had to put an extra coating on, which would have taken away the permeability and they would have had to make the metal hotter.

MR. H. J. MEERKAMP VAN EMBDEN asked whether they experienced in the fluid bed, coarse particles which had to be sifted off.

MR. K. W. THOMPSON answered that they were fairly fussy about the material that went into the fluid bed, and they used a graded material; in other words, they made a "rain" come down and spread it across, the heavier particles entering one bin, and the lighter particles another, and the dust would blow out. They used the heavy particles for the lower coat and then the subsequent particles on the higher ones, drying the coating in air. They had racks to put them on and fans blowing against them. They liked to keep them in a room where the temperature, in the winter time, is 80 deg. F. day and night, and up to about 90 deg. F. in the summer time; it was fairly important to keep the room temperature constant.

MR. H. J. MEERKAMP VAN EMBDEN asked whether in evaporating the water in the mould, they did not get a temperature drop in the wax and then it expanded afterwards.

MR. K. W. THOMPSON replied in the affirmative but added that it had negligible effect.

MR. W. O. BEER (D. Napier & Son, Limited) said he would like to ask Mr. Thompson why he put on an extra shell coat after dewaxing, and why that was not put on during the normal shell building up process.

MR. K. W. THOMPSON said because that extra coat, after dewaxing, was worth two or three coats before. In other words, operators were adding a lot more strength by doing it afterwards. However, it considerably reduced permeability.

MR. A. DUNLOP asked what was the drying time between each dip.

MR. K. W. THOMPSON stated that he was unable to answer that as they had never actually made a check, because they had never really wanted to lose a shell over it. As a rule, an hour or two hours was the time left between, because, it should not be forgotten, at the beginning of the film there was shown a hollow blade, which would have taken a long time to dry. They went up to six or eight hours between coats and that was the difficult problem, in fact, it was quite a technique in itself. In other words, they had to keep the blade open, they had to keep the hole open, or poke wire through so that air could blow through there. It would probably have taken two days

BICTA Discussion

before it was fired, but on ordinary pieces an hour would have been sufficient between coats.

MR. A. DUNLOP stated that his company had carried out a fair amount of work on chemical setting between each coat and drying the complete shell at the end of the operation, thus enabling the process to be mechanized. They had probably built up thinner coats than Mr. Thompson, but more often, they built up seven or eight coats in three or four minutes and then left the complete shell for five or six hours before firing.

MR. P. A. CROOKE (Samuel Osborn & Company, Limited) noticed how clean and smooth the top of the shell appeared and that they could clamp it quite comfortably to their vacuum casting machine; he asked whether they ground or otherwise cleaned the top of the shell to obtain that surface.

MR. K. W. THOMPSON affirmed that they had to keep it fairly smooth and, in fact, they put perhaps two thin pieces of asbestos on the top. They might even moisten them sometimes to prevent leakage.

MR. D. H. FARRIMOND asked if the speaker could elaborate on the casting aspect of that technique. When they had put the shell into the vacuum chamber was there delay before pouring the metal in?

MR. K. W. THOMPSON replied that pouring was done as quickly as possible at about ten inches of vacuum.

MR. D. H. FARRIMOND asked whether he found that he had to pack up the shells at all with the loose material.

MR. K. W. THOMPSON said that this was not so as the rapid cooling after pouring was one of the advantages of shell processing. It was a very desirable feature which gave a finer grain. However, there were some instances when it was of advantage to cool more slowly, as with the solid mould. In that case, they put the shell in a stainless steel flask, in a bucket, it might be said, with some material (such as sand) around it, then placed it in the oven and brought it up to 1,100 deg. C., or whatever temperature was necessary.

Possibility of Storage

MR. D. H. FARRIMOND stated that he had read in an American publication that it was claimed the process represented a useful method of storing the mould. He asked at which stage Mr. Thompson stored the shells.

MR. K. W. THOMPSON said after burn out.

MR. D. H. FARRIMOND asked whether he did not get cracking of the shell with cooling down and then re-heating again, and whether there was a complete burn out.

MR. K. W. THOMPSON, replying, confirmed that there was a complete burn out. He got all the wax out, then was able to freeze the shell or put it in the oven; it would not crack. He imagined they could store shells there for a year. If they made a few more shells than needed, to be on the safe side, and they all came out sound, then the few extra shells on hand were stored on the shelves and it was hoped that the customer would later need some more castings.

MR. D. H. FARRIMOND asked if the wax runner bars had been solid or hollow.

MR. K. W. THOMPSON replied that they had been solid. They did not make hollow ones.

MR. D. H. FARRIMOND said that he was concerned about stresses on the shell.

MR. K. W. THOMPSON conceded that this was a good point. The ones seen had been solid. They once made them hollow, but this led to a problem when they made a hollow tree; that is, when making a heavy casting, they would also make the casting as hollow as possible. They made the hollow casting go against the tree and they put a hole in so that the hollow would fit into the wax pattern; then, after dipping, they had to drill a hole through the dip coat to the wax and into the hollow tree in order to relieve the gases. After burn out the hole was patched.

MR. A. G. MASON asked if the dewaxing and firing operations were separate or could be combined into one.

MR. K. W. THOMPSON informed the questioner that these operations were carried out separately.

MR. MEERKAMP VAN EMBDEN then asked when the "raining" machine was used.

MR. K. W. THOMPSON answered that at the first dip it went into the raining machine.

The CHAIRMAN thanked Mr. Thompson for a very interesting contribution and asked the audience to join him in his thanks. He informed those present that in addition to the contributions on the programme from America, there had also been the offer of a paper from Dr. Reuter, of the Nalgo Chemical Company, entitled "Nalgo Chemical Moulds in America." Unfortunately, the programme was already complete and they were unable to incorporate it but copies were available to those interested.

(To be concluded)

EICC Competition Award

At the seventh conference of the European Investment Casters Association, held in Liège during the summer, a first prize in one section of the competition —that for the casting which best portrayed the potential development of the investment-casting process—was won by Dr. E. G. Nickel of the Deutsche Edelstahlwerke, Bochum, Germany. The casting he submitted on behalf of his company was for a motor component, and gained the award out of 54 examples put forward by members from 20 different countries. In the JOURNAL report of the conference—appearing in the issue of September 1, 1960—it was stated erroneously that this casting had been withdrawn and only the winner of the second place in this section of the competition was mentioned. Apologies are recorded to all concerned.

THE BRITISH CAST IRON RESEARCH ASSOCIATION announce that their telephone number has been changed to Redditch 2715-8.

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Raw Material Markets

Iron and Steel

Prices of some iron and steel products were increased on Monday, while others were reduced. In the official announcement of the changes, the Iron and Steel Board states that " overall, the changes made do not represent any increase in the general level of iron and steel prices." This is perfectly true—overall—but the price of common foundry iron has been raised by 11s. per ton, and foundry owners cannot be expected to look kindly on the increase, which raises the cost of making castings at a time when some markets are beginning to look decidedly shaky.

Prices of some steel products have been reduced. The changes are incorporated in the price list on page 716. Some alterations compared with last week's list do not represent any actual change in price levels; they result from a number of " presentational " changes that have been made in the official price schedules. Among these changes is a more consistent use of the term " basis price." The price for the largest quantities of all heavy steel and re-rolled products is now called the " basis price." Extras apply for smaller quantities.

Current outputs of pig-iron are maintained at a high level, the major portion of the tonnage being supplied in basic pig-iron to the steelworks. Judging by the present trend in the demand for steel, the requirements of pig-iron by the steelworks will continue at least at present levels for some time ahead, especially as deliveries of scrap remain uncertain. Producers of basic pig-iron are able to dispose of current output without difficulty.

The ironfoundries are also able to obtain all the pig-iron they require. Overall production is satisfactory, and for most types of pig-iron present deliveries could be increased if required. The engineering and speciality foundries continue to take up substantial tonnages of the low phosphorus irons and although one or two brands are limited in supply other producers of this grade are able to make good the deficiency. Hematite pig-iron can be obtained to requirements and the refined irons where required are also in good supply.

Demands for high duty castings from the motor car industry continue to decline and outputs from the foundries which cater for them are adversely affected, so that there is an extension of short-time working at many of the foundries. Many other trades which use high quality castings are specifying freely, and good production figures are obtained by the foundries concerned.

The supply of the ordinary grades of cast-iron and steel scrap continues to meet the requirements of the foundries, although recent arisings are not so plentiful as they have been. Special quality scrap continues scarce.

Only the shortage of suitable labour precludes the re-rollers from increasing their present outputs. The orders are on hand and the mills, which use mainly the mild steel qualities of steel semis, have adequate supplies to step up current outputs if more labour could be obtained. Carbons and alloy steel semis are scarce.

The demands for all the products of the re-rollers are sustained at good levels and sufficient business is on hand to keep them employed at present levels for some time ahead.

Non-ferrous Metals

Copper in London is active and the undertone is firm. Demand, which is being maintained at a high level, comes from three main sources—from UK dealers meeting contractual commitments entered into three months ago for the metal; from Europe, and from Iron Curtain countries. This situation has raised the price of the metal and the outlook is for the present price levels to be maintained in the weeks ahead. This may seem difficult to reconcile with the very adequate tonnage of metal in LME warehouses which, at the end of last week totalled 12,917 tons, but the belief is that this figure is partly loaded with metal from dealers who have been holding it pending its shipment overseas.

In the US copper is weak with the position of oversupply being apparent. Demand is desultory, metal is reported to have changed hands at below the price of 29½ cents a pound (compared with the official custom smelter and producer price of 30 cents a pound.

Tin is fairly steady in London, showing some improvement in Singapore and deceptively quiet in the United States. It is believed that the falling away of consumer interest can now be charged up to destocking which, when completed, will pave the way for a further advance in the quotation. In the US the price is below $1.03 cents a pound.

Lead is still uninteresting on both sides of the Atlantic. In London demand is no better than sporadic and the price is depressed owing to this and to the possibility of further arrivals of metal from the Continent.

Zinc in London is a nervous market with the bad days cancelling out the good days. However, the market is trying to go better but consumer interest is insufficient to push the price upwards.

Company News

F. H. LLOYD & COMPANY, LIMITED, steelfounders and engineers, of Wednesbury (Staffs)—Agreement has been reached for the acquisition of E. C. & J. Keay, Limited, constructional engineers, of Darlaston, from the Keay parent company, N. Hingley & Sons, Limited. The purchase price is £116,000 in cash for all the capital.

GAS PURIFICATION & CHEMICAL COMPANY, LIMITED—If earnings do not continue at the high rate at which they have been running during the past year they should still ensure a satisfactory return on capital invested, the chairman, Sir Charles Hughes Hallett, states. Group profit for the year to June 30 was a record £811,034 (£505,336), and the dividend is 35 per cent. (nil).

TRIPLEX FOUNDRIES GROUP, LIMITED—Reporting on trade in the six months ended September 30, the chairman, Mr. W. H. L. Harrison, says that the results reflect the steady progress of the group. The profit, after providing for all contingencies and charges except taxation, is approximately £121,000, and an interim dividend of 5 per cent., less tax, on the ordinary shares, as increased by the rights issue, is recommended.

SPEAR & JACKSON, LIMITED—Purchase consideration of an offer for the share capital of Brades & Nash Tyzack Industries, Limited, will be satisfied by the issue of 289,480 5s. ordinary shares. The directors of Brades have accepted the offer and recommend it to other holders. If the amalgamation is effected, Mr. S. M. Bartolomé and Mr. G. P. Lockwood, directors of the company, and Mr. W. R. Clayton, joint managing director of the subsidiary, C. T. Skelton & Company, Limited, will join the Brades board, the present directors of which will continue in office.

Electrical Aids in Industry *Data Sheet* **No. 15**

Electric Motors & Controls-2

Control equipment must enable the motor to be operated effectively, to obtain maximum productive efficiency. An outstanding advantage of individual electric drives is the flexibility of control available. Control equipment may be manual, semi-automatic or fully automatic, and includes gear for the following operations: starting, speed control (this subject will be dealt with in Data Sheet No. 16), reversing, stopping, switching off automatically if operating conditions become abnormal and isolation of motor and control equipment from the supply.

Every application of power has its own control requirements—and they are legion. Below are featured four uses of electric motors and their controls; they are given only as examples and represent but a small fraction of the whole picture.

Turret-lathe Control

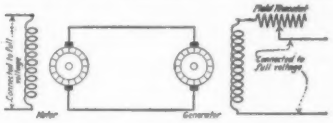
Various speeds are required for different tools, and it is possible to arrange, for instance, for a four-speed headstock, forward and reverse. By using a two-speed double-wound motor, eight speeds forward or reverse are obtainable. A dial on the headstock is set to the required speed and when a knob in the centre of the dial is pressed, the power-operated mechanism changes the speed of operation instantly.

Crane Control

This is a form of control which must be flexible yet completely foolproof. It is, for instance, possible to arrange for motor switching to be carried out by the contactors in response to movement of the crane driver's master controller. If the crane controller is moved quickly from the 'off' position to the 'last point lowering', the actual rate of acceleration is limited automatically by the relays. These also govern the retardation in order to prevent a heavy descending load being stopped too suddenly.

Planing-machine Control

Another example of motor control for machine tools is that for planing machines. For general workshop machining, the Ward-Leonard controlled motor, with a speed range of 10 to 1, gives a rapid and smooth reversal of the table travel and is ideally suited for short-stroke work. Two arrangements of Ward-Leonard control are available, the 3-machine



set with generator, exciter and driving motor, and a specially designed 4-machine set with an additional auxiliary exciter. With the 3-machine set the control equipment can include magnetic time relays which automatically adjust a regulator to strengthen the motor field at the instant of reversal and therefore greatly increase the accelerating torque. The auxiliary exciter of the 4-machine set automatically provides for the power input to the motor to be increased to give more accelerating torque at the instant of reversal.

Automatic Control

The control equipments described incorporate automatic features which help considerably towards obtaining safe and efficient operation of the driven machine, but much still depends on the human element. Braking equipment, for instance, cannot always become effective until an operative has taken some action. Devices, which will be described in other Data Sheets, 'observe' any abnormal condition and immediately and automatically initiate the braking system.

Particular attention should be paid to the positioning of controls. When a machine, or group of machines, requires a large number of push buttons and, in some cases, instruments etc., the controls can all be grouped on a desk with a mimic diagram, located in a position where the operator has full view of the work.

For further information, get in touch with your Electricity Board or write direct to the Electrical Development Association, 2 Savoy Hill, London W.C.2. TEMple Bar 9434.

They can offer you excellent reference books on electricity and productivity (8/6, or 9/- post free)—'Electric Motors and Controls' is an example.

E.D.A. also have available on free loan within the United Kingdom a series of films on the industrial uses of electricity. Ask for a catalogue.

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Basis prices, delivered unless otherwise stated)

November 30, 1960

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2, 10-ton lots or over: Middlesbrough, £21 17s. 0d.; Birmingham, £21 9s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.40 per cent. P, 10-ton lots or over, £23 5s. 0d., delivered Birmingham, £23 10s. 0d., delivered Grangemouth.

Cylinder and Refined Irons.—North Zone, £25 6s. 6d.; South Zone, £25 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.; North Zone, £26 6s. 6d.; South Zone, £26 9s. 0d.

Hematite.—Si less than 2 per cent, S. & P. over 0.03 to 0.05 per cent., 10-ton lots or over; N.-E. of England (local iron), £23 19s. 0d.; Scotland (Scotch iron), Zone S.1, £24 5s. 6d.; Sheffield, £25 9s. 0d.; Birmingham, £25 13s. 0d.; Wales (Welsh iron), £23 19s. 0d.

Basic Pig-Iron.—£20 3s. 0d., delivered Staffs, Derbyshire, Notts, Lincs, Rutland, Northants, and Leicestershire in 10-ton lots or over.

FERRO-ALLOYS

(per ton unless otherwise stated, delivered)

Ferro-Silicon (6-ton lots and over).—45 per cent. Si, £43 10s. 0d. to £46 0s. 0d., scale 15s. 0d. per unit, lumpy. 75 per cent. Si, £59 0s. 0d. to £63 10s. 0d., scale 15s. 0d. per unit, lumpy.

Ferro-vanadium.—50/60 per cent., 20s. 6d. per lb. of V.

Ferro-molybdenum.—65/70 per cent., carbon-free, 12s. 10d per lb. of Mo.

Ferro-titanium.—20/25 per cent., 2-3 per cent. Cu, £250 0s. 0d.; 38/40 per cent., commercially carbon-free, £287 0s. 0d.

Ferro-tungsten.—80/85 per cent., 11s. 8d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 14s. 8d. per lb. of W.

Ferro-chrome (6-ton lots and over, lumpy).—4/6 per cent. C, £81 10s. 0d. to £84 10s. 0d., basis 60 per cent. Cr scale 27s. 0d. to 28s. 6d. per unit; over 6 per cent. C, £79 0s. 0d. to £82 10s. 0d., basis 60 per cent. Cr, scale, 27s. 0d. to 28s. 6d. per unit; 2 per cent. C,* 1s. 8d. to 1s. 11d. per lb. Cr; 1 per cent. C,* 1s. 8d. to 1s. 11½d. per lb. Cr; 0.15 per cent. C,* 1s. 9½d. to 2s. 0½d. per lb. Cr; 0.10 per cent. C,* 1s. 9¾d. to 2s. 0¾d. per lb. Cr; 0.06 per cent. C,* 1s. 11d. to 2s. 1d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 6s. 10d. per lb.

Metallic Manganese.—94/96 per cent., carbon-free, £275 0s. 0d.; 96/98 per cent., £285 0s. 0d.

Ferro-columbium.—65/67 per cent., Cb + Ta, 19s. 9d. per lb., Cb + Ta.

Ferro-manganese (Standard).—78 per cent., £61 10s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft u.t., 100 tons & over, £31 15s. 6d.; tested, 0.08 to 0.33 per cent. C, 100 tons & over, £32 5s. 6d.; hard (0.41 to 0.60 per cent. C), 50 tons and over, £33 17s. 0d.; silico-manganese, 50 tons and over, £42 16s. 6d.; free-cutting, 50 tons and over, £35 4s. 6d. SIEMENS MARTIN ACID (50 tons and over): Up to 0.25 per cent. C, £40 11s. 0d.; silico-manganese, £43 4s. 0d.

Billets, Blooms, and Slabs for Forging and for Stamping (50 tons and over).—BASIC: Soft, up to 0.33 per cent. C, £37 0s. 0d.; basic, hard, over 0.41 up to 0.60 per cent. C, £38 2s. 6d.; acid, up to 0.25 per cent. C, £41 14s. 0d.

FINISHED STEEL

Heavy Plates and Sections (50 tons and over).—Ship plate (N.-E. Coast), £40 7s. 0d.; boiler plates (N.-E. Coast), £42 17s. 0d.; floor plates (N.-E. Coast), £41 16s. 0d.; angles (N.-E. Coast), £38 1s. 6d.; joists (N.-E. Coast), £37 17s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., and flats 5 in. wide and under, untested soft basic, 50 tons and over, £39 1s. 0d.; under 10 tons to 4 tons, £40 18s. 6d.; under 4 tons to 2 tons, £41 3s. 6d.; hoop and strip, coils, 100 tons and over, £38 0s. 0d.; uncoated strip mill coils, hot rolled, under 3 mm. to 12g., 25 tons to under 50 tons, £43 16s. 0d.; black sheets (hand mill), 24g., 10 tons and over, £57 14s. 6d.; galvanized corrugated sheets, 24g., 10 tons and over, £68 5s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £66 7s. 0d.; nickel-chrome, £97 1s. 0d.; nickel-chrome-molybdenum, £109 14s. 0d., in lots of 25 tons and over.

NON-FERROUS METALS

Copper.—Cash, £231 0s. 0d. to £231 5s. 0d.; three months, £227 15s. 0d. to £228 0s. 0d.; settlement, £230 5s. 1d.

Copper, Tubes, etc.—Solid-drawn tubes, 2s. 2¾d. per lb.; rods, 245s. 6d. per cwt. basis; 20 s.w.g., 280s. 6d. per cwt.

Tin.—Cash, £798 10s. 0d. to £799 10s. 0d.; three months, £797 10s. 0d. to £798 0s. 0d.; settlement, £799 10s. 0d.

Lead (Refined Pig).—First half December, £66 15s. 0d. to £67 0s. 0d.; first half March, £67 15s. 0d. to £67 17s. 6d.

Zinc.—First half December, £86 15s. 0d. to £87 0s. 0d.; first half March, £86 0s. 0d. to £86 2s. 6d.

Zinc Sheets, etc.—Sheets, 15g., and thicker, all English destinations, £123 0s. 0d.; rolled zinc (boiler plates), all English destinations, £120 15s. 0d.; zinc oxide (Red Seal) d/d buyers' premises, £100 0s. 0d.

Brass Tubes, etc.—Solid-drawn tubes, 1s. 10¾d. per lb.; sheets to 10 w.g., 203s. 0d. per cwt.; wire, 2s. 8½d.; rolled metal, 203s. 0d. per cwt.

Brass (Brazing).—BS1400, B3, £175; B6, £226.

Brass (High Tensile).—BS1400, HTB1, £196; HTB2 £213; HTB3, £233.

Gunmetal.—BS1400, LG2, £219; LG3, £228; G1, 1% £292; G1, 1%, £282.

Phosphor Bronze.—BS1400, PB1 (AID released), £311; BS1400, 90/10/1, £299.

Leaded Phosphor Bronze.—BS1400, LPB1, £240.

Phosphor Bronze Strip, etc.—Strip, 287s. 3d. per cwt.; wire, 4s. 0¾d. per lb.; rods, 3s. 3¾d.; tubes, 3s. 3¾d.; chill cast bars, solids 3s. 3½d.; cored 3s. 4½d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 3s. 10d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 3d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 2d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 2½d. to 2s. 3d. per lb.; Antimony, English, 99 per cent., £200 0s. 0d. Quicksilver, ex-warehouse, £70 10s. 0d. Nickel, £600 0s. 0d. Aluminium, ingots, £186 0s. 0d.; aluminium bronze (BS1400), AB1, £247; AB2, £255.

* Average 68-70 per cent.

Increases in Capital

INERTIA SWITCH, LIMITED, electrical and mechanical equipment specialists, etc., of London, W.C.2, increased by £5,000, in £1 ordinary shares, beyond the registered capital of £5,000.

ARMSTRONG TARRY & COMPANY, LIMITED, engineers and merchants, etc., of Liverpool, increased by £30,000, in £1 ordinary shares, beyond the registered capital of £20,000.

YORKSHIRE COPPER WORKS (HOLDINGS), LIMITED, Leeds, increased by £626,172, in £1 5 per cent. cumulative second preference shares, beyond the registered capital of £3,269,399.

W. RICHARDSON & COMPANY, LIMITED, horticultural builders, engineers, etc., of Darlington, increased by £50,000, in £1 preference shares, beyond the registered capital of £100,000.

BERISFORDS, LIMITED, smallware manufacturers and merchants, etc., of Congleton (Ches), increased by £5,000, in £1 ordinary shares, beyond the registered capital of £120,000.

NEALE, WRIGHT & COMPANY, LIMITED, agricultural machinery manufacturers, etc., of Leamington Spa, increased by £9,000, in £1 ordinary shares, beyond the registered capital of £1,000.

E. H. BENTALL & COMPANY, LIMITED, engineers, machinery manufacturers, etc., of Maldon (Essex), increased by £200,000, in 5s. ordinary shares, beyond the registered capital of £300,000.

MIDLAND PNEUMATIC, LIMITED, manufacturers of controls, machines, tools, etc., of Wolverhampton, increased by £2,500, in £1 preference shares, beyond the registered capital of £12,000.

JAMES COUPER & COMPANY, LIMITED, engineers, etc., of Croydon (Surrey), increased by £49,000, in £1 6 per cent. cumulative preference shares, beyond the registered capital of £1,000.

HOVERINGHAM ENGINEERING COMPANY, LIMITED, iron founders, mechanical engineers, etc., of Hoveringham (Notts), increased by £9,000, in £1 ordinary shares, beyond the registered capital of £1,000.

MULTI-SPRING, LIMITED, spring manufacturers, etc., of Mitcham (Surrey), increased by £5,000, in £1 10 per cent. cumulative preferenme shares, beyond the registered capital of £20,000.

FLETCHER HOUSTON & COMPANY, LIMITED, iron, steel, and hardware manufacturers, etc., of Tipton (Staffs), increased by £400,000, in 1s. ordinary shares, beyond the registered capital of £100,000.

R. HARRIS (BRASSFOUNDERS), LIMITED, Birmingham, increased by £5,000, in 4,000 7½ per cent. redeemable preference and 1,000 ordinary shares of £1 each, beyond the registered capital of £10,000.

BURDETTE & COMPANY, LIMITED, electrical and general engineers, etc., of London, S.W.4, increased by £55,000, in £1 7 per cent. redeemable preference shares, beyond the registered capital of £45,000.

BURNETT & ROLFE (HOLDINGS), LIMITED, engineers, etc., of Rochester (Kent), increased by £10,868, in £1 7½ per cent. irredeemable cumulative preference shares, beyond the registered capital of £104,000.

MARKLAND SCOWCROFT, LIMITED, general engineers, etc., of Bromley Cross, near Bolton, increased by £100,000, in 15,000 preference and 85,000 ordinary shares of £1 each, beyond the registered capital of £200,000.

DERITEND STAMPING COMPANY, LIMITED, stampers, piercers and workers in iron, etc., of Blackheath, near Birmingham, increased by £750,000, in 10s. ordinary shares, beyond the registered capital of £750,000.

MILES DRUCE & COMPANY, LIMITED, machinery and metal merchants, etc., of London, W.3, increased by £250,000, in 5s. ordinary shares, beyond the registered capital of £750,000. The 90,000 unclassified shares of £1 each have been divided into 5s. shares.

GRIFFIN AND GEORGE GROUP OF COMPANIES, Ealing Road, Alperton, Middlesex, have initiated a series of awards for long service, and the first presentations were made by Mrs. K.G. Sinclair, wife of the chairman, at dinner held at the Waldorf Hotel, London, on November 25. Seventeen members with between 40 and 49 years of service each received a gold watch, and another 50 received Parker pen and pencil sets for between 25 and 29 years. The scheme provides recurring and increasing financial benefits for employees who have completed between 5 and 25 years of service. Thereafter, and in addition, presentations of gifts will be made to those who have served for 25, 40 or 50 years with the company.

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Personal

As a consequence of the death of the company's chairman, Sir Cecil Weir, the directors of International Computers and Tabulators, Limited, announce that pending the appointment of a chairman Mr. H. V. STAMMERS is appointed acting chairman. Mr. C. MEAD becomes a deputy chairman, and Mr. J. BULL, managing director.

Mr. HARRY WEST has been elected a director of Associated Electrical Industries, Limited, as from January 1, 1961. He is managing director of Associated Electrical Industries (Manchester), Limited, and a director of other companies associated with the group, including Metropolitan - Vickers - Beyer, Peacock, Limited.

Sir JOHN GREEN has resigned from the boards of the Staveley Iron & Chemical Company, Limited, Staveley Estates, Limited, and the Sheepbridge Company, Limited. Sir John was appointed to the board of Staveley in 1955 as nominee of the Iron and Steel Holding Realization Agency. Recently the Agency sold the company to Stewarts and Lloyds, Limited.

Sir AUBREY BURKE has been elected an additional director of Dominion Steel & Coal Corporation, Limited, and a subsidiary, Dominion Coal Company, Limited. Sir Aubrey is chairman of De Havilland Holdings Company, Limited, and deputy managing director of the parent, Hawker Siddeley Group, Limited. He also holds several other board appointments.

Mr. CHARLES T. WYATT has been appointed chief inspector of Dartmouth Auto Castings, Limited, Smethwick, upon the retirement of Mr. H. MASON, who has been with the company for 27 years. Mr. Wyatt who has been assistant works manager for two years, was previously assistant chief inspector. Mr. ROGER M. LACKNER succeeds Mr. T. E. GIBBS as production manager.

Mr. W. H. DEVENISH, who is the deputy head of the British Electrical and Allied Industries Research Association's member-relations department, is visiting India. In New Delhi he will attend the plenary meeting of the International Electrotechnical Commission, primarily as the chief British delegate to the technical committee on insulating materials. At Mysore, Mr. Devenish will address the local centre of the Institution of Engineers (India) on the work of the ERA. He is due to return to England this month.

Mr. ERIC E. JONES, group commercial director of the Solartron Electronic Group, Limited, Farnborough, Hants, is leaving to become managing director of Adrema (Holdings), Limited, Telford Way, London, W.3, and its subsidiaries, including the Bradma companies. He will at the same time become European vice-president of the Farrington Manufacturing Company, Needham Heights, Massachusetts, USA, parent company of Adrema (Holdings), Limited. Mr. ROBERT S. CRANSTON, who Mr. Jones succeeds, is retiring.

Sir WILLIAM FENTON, chairman of British Belting & Asbestos, Limited, Cleckheaton, has been elected chairman of the East and West Ridings Regional Council of the Federation of British Industries in succession to Mr. GEOFFREY HIRST, M.P. for Shipley. Mr. J. HUGH NEILL has been appointed deputy chairman.

Mr. JOHN BOARDMAN has been appointed chairman and chief executive of Burtonwood Engineering Company, Limited, in succession to Mr. R. DUTTON FORSHAW who resigned from the board on November 14. Mr. BERNARD C. SHRUBSOLE, joint managing director of U.S. Industries, Inc. (Great Britain), Limited, has also been appointed to the board. Burtonwood Engineering is a subsidiary of U.S. Industries.

Presentations have been made to Sir FREDERICK NEILL, chairman and managing director, James Neill & Company (Sheffield), Limited, Napier Street, Sheffield, to mark the completion of 50 years' service with the company. He joined the family business in 1910. It was then under the direction of his father, the late Mr. James Neill, who founded the company. He became a director in 1916, and chairman and managing director in 1930 on the death of his father. He has seen the concern develop from a single firm with 30 workers to a group of 14 companies with 2,250 employees. The presentation was made by his son, Mr. J. Hugh Neill, deputy chairman and joint managing director, at the annual dinner of the company's "Twenty-Five" Club attended by 100 long-serving employees of whom only one had more service with the firm than the chairman.

Mr. F. BURGESS (Whites-Nunan, Limited) has been re-elected chairman of the British Valve Manufacturers' Association for the year 1960/61, and Mr. K. M. Leach (Audley Engineering Company, Limited) has been re-elected vice-chairman. Other members of the executive committee for the year 1960/61 are as follow:—Mr. D. Bailey, Sir W. H. Bailey & Company, Limited; Mr. B. S. Bass, Dewrance & Company, Limited; Mr. D. S. Birkett, Samuel Birkett, Limited; Mr. W. R. Blakeborough, J. Blakeborough & Sons, Limited; Mr. G. F. Chambers, the Bryan Donkin Company, Limited; Mr. F. S. Ham, Ham, Baker & Company, Limited; Mr. H. R. Hammond, Crane, Limited; Mr. N. P. Newman, Newman, Hender & Company, Limited; Mr. T. B. Pattison, Alley & MacLellan, Limited; Mr. A. Robertson, Glenfield & Kennedy, Limited, and Mr. A. Trump, Saunders Valve Company, Limited.

The President of the Board of Trade has announced the constitution of the Export Council for Europe. Amongst those serving are:—The chairman, Sir WILLIAM MCFADZEAN, president, Federation of British Industries, chairman and managing director, British Insulated Callender's Cables, Limited; Mr. J. A. BIRCH, chairman, Trades Union Congress Economic Committee; Sir JAMES HUTCHISON, BT., D.S.O., T.D., J.P., president, Association of British Chambers of Commerce; Sir NORMAN KIPPING, J.P., director-general, Federation of British Industries; Mr. MORTON OLIPHANT, M.B.E., T.D., president, National Union of Manufacturers; Mr. A. J. S. BROWN, director, Stone-Platt Industries, Limited; Sir JOSEPH LOCKWOOD, chairman, Electric & Musical Industries Limited; Mr. HECTOR MCNEIL, managing director, Babcock & Wilcox Limited; Mr. J. HUGH NEILL, deputy chairman and joint managing director, James Neill & Company (Sheffield), Limited; Mr. A. G. NORMAN, D.F.C., managing director, De La Rue Company, Limited; Mr. O. F. REICHWALD, managing director, Daniel Adamson & Company, Limited, Dukinfield; the Hon. BRIAN ROOTES, managing director, Rootes Limited; Mr. E. W. SENIOR, C.M.G., commercial director, British Iron and Steel Federation; Mr. J. C. SNOW, director, Snow & Company, Limited, Sheffield, president-elect, Machine Tool Trades Association; Mr. P. F. D. TENNANT, C.M.G., O.B.E., overseas director, Federation of British Industries; Mr. R. W. WEEKES, managing director, Harland Engineering Company, Limited, Alloa and Mr. RICHARD L. WILLS, M.C., managing director, George Wills & Sons, Limited.

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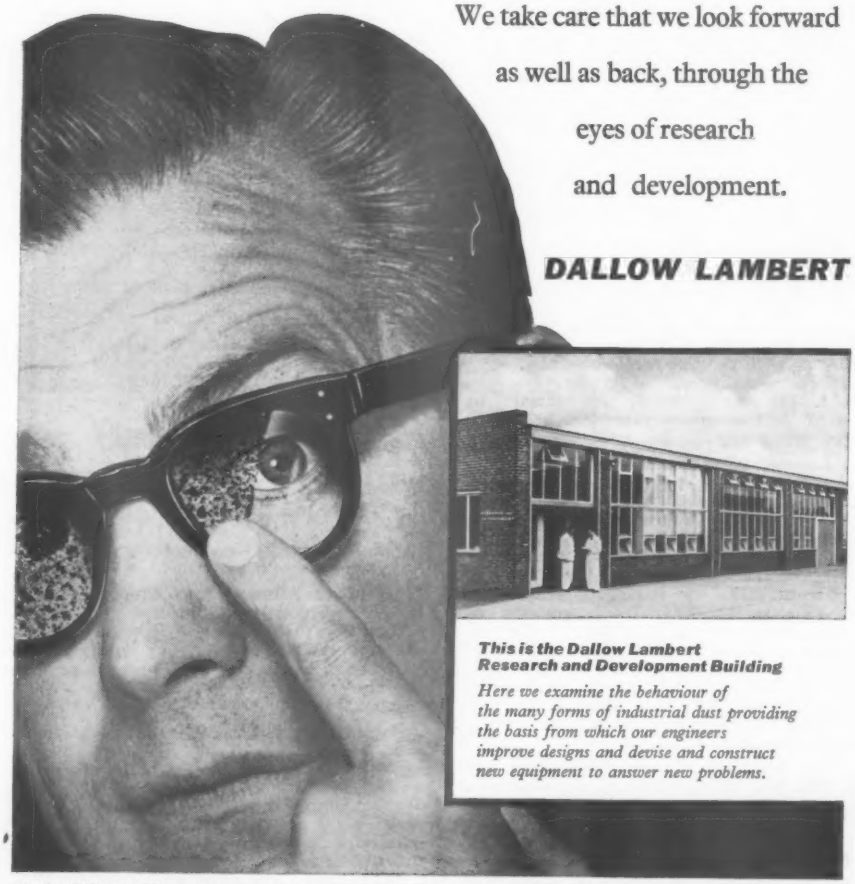

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CRC 92

News in Brief

ORDERS FOR NEARLY 500 BUS and truck chassis and trailers, valued at nearly £1,000,000, have been placed with the Leyland Group this year by Pakistan—over six times as many as in 1959.

SHEFFIELD AND DISTRICT FIRMS have contributed to the construction of Britain's newest luxury liner, the £14,000,000 Oriana, of 45,200 tons, which makes its maiden voyage to Australia on December 3. English Steel Forge & Engineering Corporation, Limited, Don River Works, supplied a giant forging for a rudder bearing-block; Hadfields, Limited, fabricated special heat-resisting plates for boiler installations; the Harleston works of Moorwoods, Limited, supplied galley gear; the Chesterfield Tube Company, Limited, produced a new design of the ultra-tough chrome molyvanadium type of tubing; and Mappin & Webb, Limited, supplied the 65,200 piece cutlery equipment.

THE GLASGOW FIRM of Matthew Wylie & Company, Limited, have started production, under licence, of a German-designed machine for the manufacture of plastic containers. The product is a fully automatic blow-moulding machine capable of producing about 1,200 plastic bottles per hr. This is a completely new line of development for the firm which up till now has concentrated on supplying wooden box-making and bottle-labelling machinery. Installation of the first ordered machines has already commenced and orders have been received for several of the machines at present being built. It is anticipated that in due course 150 to 200 more people will be employed by the firm.

ACCORDING TO THE AUSTRALIAN NAVY MINISTER, Australia is to acquire six modern minesweepers; a survey ship; and possibly a number of anti-submarine helicopters. Four of the minesweepers will be bought in Britain "off the shelf" and be modified to suit Australian conditions; the other two ships may be built in Australia if price and delivery date are comparable to those of oversea shipbuilding yards. The survey ship, of about 2,000 tons, will be built in Australia. If a firm price were obtained, anti-submarine helicopters will be bought for the Australian carrier HMAS Melbourne, which will remain in commission after 1963 as an anti-submarine helicopter carrier instead of retiring to the mothball fleet.

PHILIPPINE BASE-METAL PRODUCERS have once more sought the assistance of their Agriculture and Commerce Departments in meeting some of their urgent problems. Writing to the Department of Agriculture and Natural Resources, the Base Metals Association proposed the following three areas of assistance:—(1) Amendment of the present mining law and the corporation law to make the mining industry more attractive to new venture capital; (2) granting of dollar allocations to base-metal producers at the preferential rate of exchange to cover their import requirement and enable them to reduce operating costs; (3) revision of the tax rates imposed on the industry to ease the present tax burden on major dollar producers and enable the Philippine industry to compete in the Japanese market.

CRITICISM by members of the Government and others suggesting that managements of manufacturing companies and their sales executives neglect export trading is "unfair," says Mr. Frank A. Hirst, chairman of the Samuel Osborn Group, Sheffield. In his report he points out that such criticism serves only to make workpeople suspect the ability of those who direct commercial undertakings. "Also, statesmen and others seem to fail to realize the damage which is done to overseas trade by reckless statements." Mr. Hurst says the majority of the companies in the group have been working to capacity during the past year and the company has achieved the highest sales figure in its history. The record trading profit of £1,533,000 was 40 per cent. higher than last year's figures. Prospects are good, and the order-book ensures full employment for some time ahead.

ADDRESSING members of the West Midland branch of the Institute of Export in Birmingham, Mr. K. B. Atkinson, the United States Consul in Birmingham, said there was room for improvement in servicing and advertising in American markets. The market for British cars was still strong in the States and he urged British car manufacturers whose sales to America have recently suffered a decline, not to be discouraged. Mr. Atkinson suggested the experiment of running an all-British service centre which made the most of advertising British craftsmanship, Washington being an ideal place to try such an experiment because of its high proportion of imported cars. Spare parts organizations needed to be established on each side of the United States because difficulty in getting spare parts was one of the chief reasons why Americans might become "a little sour towards foreign cars."

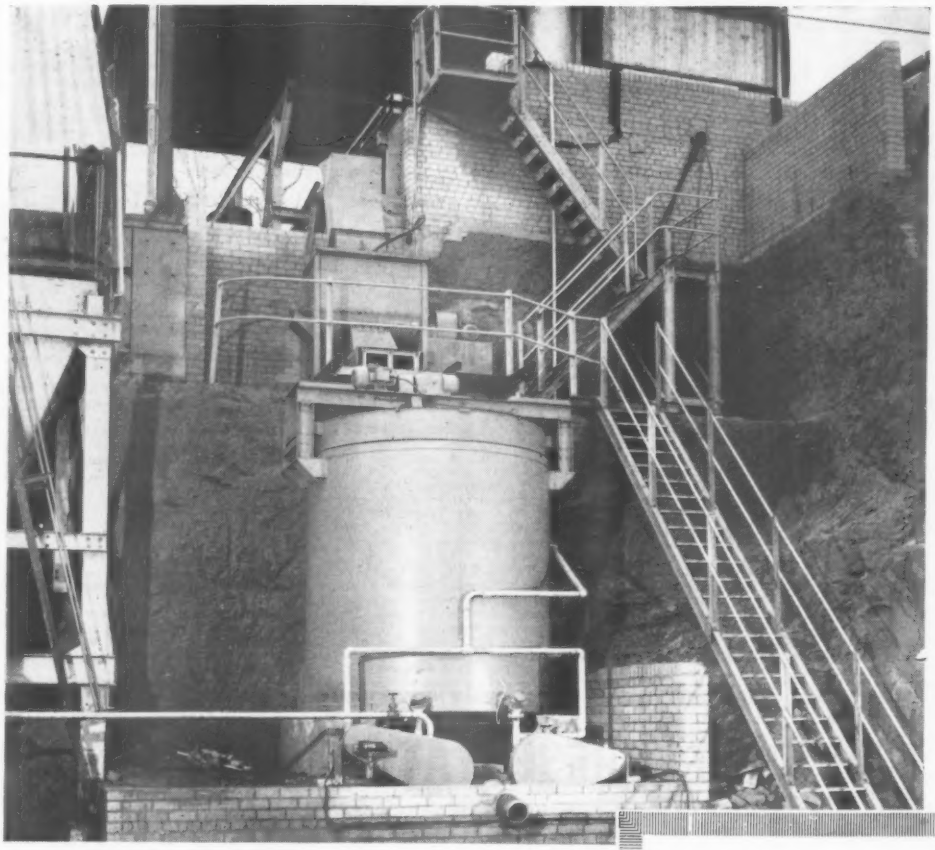
RICHARDSONS WESTGARTH have recently despatched to the Sheikdom of Abu Dahbi, on the Trucial Coast, a vacuum-flash evaporator plant believed to be the first of its kind. This is a fully self-contained sea-water evaporator which will produce 14,400 gal. of drinking water a day. At the moment, the only supply of drinking water in Abu Dahbi is brought in by dhow at considerable expense. An unusual feature of this evaporator is that it has been designed to float on its own pontoon. There are no port facilities at Abu Dahbi and the plant will be lowered into the sea some miles off the coast, and will be towed in to the beach. With the aid of a winch, which forms part of the plant, it will then be hauled up the beach on to a concrete foundation. It remains then only to connect up to a fuel supply, and to run sea-water pipes to the plant, and the evaporator will be ready to produce fresh water. The pontoon remains part of the plant and will be used for storage of the water produced.

Obituary

Mr. HARRY IBBOTSON, light castings manager at Newton Chambers and Company, Limited, Chapeltown, until his retirement, died on November 19 at the age of 89. He was with the firm for 55 years.

The French technical Press announces the death of Mr. EDMOND LAFFLY at the age of 60. His major interests were in the field of light alloys and he was honorary president of the group covering this activity of the *Syndicat General des Fondeurs de France* and honorary treasurer of the *Association Technique de Fonderie*.

The death is announced of Sir JOHN E. THORNYCROFT, K.B.E., at the age of 88. He was chairman and governing director of John I. Thornycroft & Company, Limited, Southampton. The son of a shipbuilder, Sir John I. Thornycroft, F.R.S., he started work at the firm's shops in Chiswick, and later pioneered the building of fast torpedo-boat destroyers. He was also interested in road transport, first at Chiswick and later at Basingstoke. His elder son, Mr. John W. Thornycroft, succeeds him as chairman and managing director of the company.



Baker Perkins Foundry Machinery at work... *at Mansfield Standard Sand Co. Ltd.*

This Clay Slurry Plant was built at Mansfield by Baker Perkins. Clay is added to standard sand in quantities which vary to suit the foundry customer concerned. The plant includes a Simplex Mixer, a storage tank, a vibratory screen (to remove oversize material) and pumps. An immersion heater prevents winter freezing. This is one of the many examples of machinery for the foundry and allied industries by Baker Perkins—the firm that supplies the complete range.

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HISTORICAL NOTE

Mansfield Standard Sand Company has been supplying Foundries for one and a quarter centuries and is the sole producer of Mansfield Moulding Sand—known throughout these islands and the world over for its 'standard' quality. The Company is now producing a new range of 'standards' by blending natural sands to give constant strength and a choice of several controlled permeabilities.

CLASSIFIED ADVERTISEMENTS

PREPAID RATES: **Twenty words for 10/- (minimum charge) and 4d. per word thereafter. Box numbers 2/6 extra per insertion (including postage of replies). Situations wanted 2d. per word throughout.**

Advertisements (accompanied by a remittance) and replies to Box Numbers should be addressed to the Advertisement Manager, Foundry Trade Journal, John Adam House, 17/19, John Adam Street, Adelphi, London, W.C.2. If received by first post Monday advertisements can normally be accommodated in the following Thursday's issue.

SITUATIONS WANTED

TECHNICAL REPRESENTATIVE with extensive connection in London and Home Counties with large industrial groups wishes to represent a foundry for cast iron non-ferrous die castings etc. Good personal connection, commission and part expenses. Box TR981, FOUNDRY TRADE JOURNAL.

SALES ENGINEER — TECHNICAL REPRESENTATIVE. Grammar school, foundry apprenticeship, experienced in light alloy castings, sand, gravity, pressure, seeks similar post with prospects. Resident Birmingham. Box SE985, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT

STEEL FOUNDRY METHODS ENGINEER required for fully mechanised foundry. Applications are invited from experienced men to fill a permanent staff position. Write, stating age, experience and salary required, to JOHN FOWLER & CO. (LEEDS), LTD., Sprotborough Foundry, Doncaster.

SITUATIONS VACANT—*contd.*

TECHNICAL ENGINEER for Lancashire and Yorkshire required by well-known established British manufacturer of moulding machines, sand plant, cleaning equipment, cupola plant, etc. Applications invited from men having the practical knowledge necessary for the satisfactory sale and servicing of such equipment. Write giving details of experience and salary required to Box TE939, FOUNDRY TRADE JOURNAL.

MOULDER. Practical, capable man for supervisory position in West Yorkshire Foundry producing grey iron up to 15 tons. Progressive position with excellent prospects of advancement. Full details required of experience and salaries earned to Box MP966, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN. Practical man required for Yorkshire Iron Foundry producing castings up to 12 tons. Exceptional Prospects for well trained/man capable of accepting responsibility. Applications should give full particulars of past experience and state salary required to Box FF967, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—*contd.*

ASSISTANT TO FOUNDRY MANAGER required by Malleable Foundry in South Africa. Must have sound knowledge of Malleable Foundry practice. Good salary and contract offered to right man. British personnel already on our staff. Box AT950, FOUNDRY TRADE JOURNAL.

METAL PATTERNMAKER required by Malleable Foundry in South Africa. Must be good all-round man with working knowledge of Malleable Foundry practice. Good salary and contract offered to right man. British personnel already on our staff. Box MP951, FOUNDRY TRADE JOURNAL.

FOUNDRY FOREMAN wanted for progressive position in the Iron Foundry of a Machine Tool Works situated in the West Riding of Yorkshire. Applicants must have practical experience on Grey Iron castings of 2 tons upwards. Please give full particulars including present salary in strict confidence to Box FF953, FOUNDRY TRADE JOURNAL.

SENIOR REPRESENTATIVE

for a long-established private company of metal merchants. Initial salary will be in the range £1,200-£1,450 plus substantial bonus, company car and pension scheme.

The Senior Representative, who will be responsible directly to the Board, will take over responsibility for Sheffield and the surrounding area. His main function will be to maintain existing accounts and develop new ones in the whole range of ferrous and non-ferrous materials. He will have considerable freedom of activity in planning and implementing his work.

The main essential requirements are at least five years' experience in selling to metal-using industries, preferably in the North and North Midlands, and evidence of a capacity to plan and organise his own work. Knowledge of ferrous and non-ferrous metals and of manufacturing processes in metal-using industries would be of advantage. Preferred age 28-45.

Please write briefly in first instance, quoting Reference No. 924, to:—

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ASHLEY ASSOCIATES LIMITED
PETER HOUSE · MANCHESTER 1
Retained to advise on this appointment
THE STRICTEST CONFIDENCE WILL BE OBSERVED AND NO DETAILS OF CANDIDATES WILL BE PASSED TO CLIENTS WITHOUT CANDIDATES' PERMISSION

SITUATIONS VACANT—contd.

PLANNING ENGINEER required for expanding Company in the Midlands producing small pressed parts. This is an excellent opportunity for a man with initiative and enthusiasm. Commencing salary in the range of £1,000 to £1,250, depending on experience and qualifications. —Box PE956, FOUNDRY TRADE JOURNAL.

STEEL FOUNDRY in North of England requires ESTIMATOR, capable of extracting weights from drawings, and knowledge of Methods an advantage. This is a staff appointment. Write stating age, experience and salary required to Box SF958, FOUNDRY TRADE JOURNAL.

SALES REPRESENTATIVE. Large engineering concern in the West of Scotland area requires a young energetic sales representative to promote the sale of iron and steel castings in the open market. Applicants should be fully conversant with all aspects of Iron and Steel Founding and have had previous sales experience in this field. Salary will be awarded in accordance with qualifications and experience. Apply Box SR963, FOUNDRY TRADE JOURNAL.

RESEARCH ASSISTANT required for work on vacuum melting and processing of specialised alloys. Preferred age 20-30 and qualifications H.N.C. or equivalent in Metallurgy or Engineering. Salary in accordance with age and experience. This is an interesting and progressive post in a modern and expanding Company. Assistance with housing possible. Write in confidence to: RESEARCH MANAGER, TELCON METALS LTD., Manor Royal, Crawley, Sussex.

REORGANISATION of Foundry Sand Quarry. Imaginative and vigorous personality to reorganise and improve quarry plant and production. Object to improve product and increase sales and to gradually increase and introduce other lines. Must, to begin with, be willing to participate physically in such quarry production until organised to his satisfaction. Actual mechanical handling experience and knowledge of foundry practice desirable. Present production about 55,000 tons per annum. May interest Foundry Manager, Transport Manager, etc., or University Graduate. Able to take sole charge after about six months. Near Birmingham. Box RO977, FOUNDRY TRADE JOURNAL.

CATTON & CO. LTD. require a CHIEF RATE FIXER to take over a small existing rate fixing section and to build this up to efficiently cover steel foundry production departments making castings in the 1-10,000 lb. range. Steelfounding and rate fixing experience desirable and details of these, together with other relevant personal information, should be quoted when replying. The appointment is at Senior Staff level and as such will carry pension benefits. Assistance with housing will also be provided if required. Replies—which will be treated in confidence—should be forwarded to the TECHNICAL DIRECTOR, CATTON & CO. LTD., 29 Chadwick Street, Leeds, 10.

REPRESENTATIVE required for grey iron foundry producing small machine, bench and floor castings up to 1 ton in Grades 12, 14, 17. Established area North of Potteries, including Lancashire, Yorkshire and Cheshire. Previous sales and technical experience essential. Car provided. Non-contributory pension scheme. Write giving full particulars to PERSONNEL MANAGER, ALFRED ELLISON LTD., Perry Barr, Birmingham 22B.

SITUATIONS VACANT—contd.

TECHNICAL SALES REPRESENTATIVES required, one for Scotland and one for South Yorkshire and Lincolnshire. Age up to 35 years and resident in area concerned. Must be capable of making practical demonstrations of Core Binders, Cold-setting Binders, also Precoated Sand for shell moulding and shell core making. Company car, pension scheme, expenses and commission provided. Permanent positions for right men. Send details of age, experience and salary required to:—FORDATH ENGINEERING CO. LTD., Hamblet Works, Brandon Way, West Bromwich, Staffs.

ASSISTANT FOREMAN for up to date Aluminium Gravity Diecasting Foundry. Excellent scope for a younger man with initiative, drive and a keen sense of discipline. Please state age, experience and salary required.—Box AF957, FOUNDRY TRADE JOURNAL.

YOUNG Foundry Technician with experience in jobbing and mechanisation required for a Belgium Foundry to start as ASSISTANT MANAGER. Initiative and ability is essential, as after a suitable period of adaptation the position of Manager will become available. Write stating full qualifications and experience to Box YF954, FOUNDRY TRADE JOURNAL.

ALUMINIUM DIE CASTING FOREMAN — Western Ireland — for new gravity die casting foundry with pressure die casting planned shortly. New housing available. Salary £900—£1,100 depending experience. Write PROGRESS (UNIVERSAL) LTD., 590/594 Wandsworth Road, London, S.W.8.

EXPERIENCED PLANNING ESTIMATOR required for Gravity Die Shop. Preferably with knowledge of Work Study. Apply, giving details of age, experience, and salary required to: PERSONNEL MANAGER, KENT ALLOYS LIMITED, Temple Manor Works, Strood, Rochester, Kent.

PLANNING ENGINEERS required by expanding Company of Aluminium Founders and light Engineers. Planning experience is desirable, but all-round Foundry experience is essential. Good salary to right applicants. Apply giving full details of training, qualifications, etc., to:—

Personnel Officer,
DEANS & SON (YORKSHIRE) LTD.
Grovehill, Beverley, Yorkshire.

SKILLED MOULDERS required by large South Wales Iron Foundry. Applicants should be experienced in the production of large high grade Iron Castings in Green, Dry or Loam Sand. Please reply to Box SM980, FOUNDRY TRADE JOURNAL.

METALLURGICAL CHEMIST (Assistant), experienced in routine analysis of tin and lead based alloys, residues, etc. Five-day week. WHITEMETAL SMELTING CO., LTD., Abbey Mills, Waltham Abbey, Essex. Telephone: Waltham Cross 23311 (3 lines).

FOUNDRY PRODUCTION EXECUTIVE, age between 40/45, required for large Midlands Grey Iron Foundry supplying the Automotive and Engineering trades. Must be thoroughly experienced in Foundry practice with sound knowledge of modern techniques. Commencing salary £2,000 p.a. Pension and Life Assurance schemes in operation. Apply in confidence, giving details of experience to Box FP988, FOUNDRY TRADE JOURNAL.

SITUATIONS VACANT—contd.

BRITISH RAILWAYS
London Midland Region

require a

WORKS METALLURGIST

at Derby Locomotive Works.

Must have served an approved Apprenticeship in an Engineering Works and have an up-to-date knowledge of materials and processes used in modern Engineering Workshops and Foundries. A sound knowledge of metallurgy essential. Technical qualifications an advantage.

Salary £925 per annum, rising after two years to £1,000 per annum.

Residential and other travelling facilities. Superannuation scheme.

Apply to:

Chief Mechanical & Electrical Engineer, British Railways, London Midland Region, Nelson Street, Derby.

FOUNDRY SUPERINTENDENT for jobbing sand foundry on quality and specialised aluminium alloy castings—A.I.D. etc. conditions. Apply to: UNIVERSAL CASTING DEVELOPMENTS LTD., 269 Rotherhithe New Road, Bermondsey, London, S.E.16. Telephone Bermondsey 1337/8.

FOUNDRY MANAGER urgently required for old established Non-ferrous Foundry in the Birmingham area. Excellent salary and prospects. Full details in confidence to PERSONNEL MANAGER, Box FM976, FOUNDRY TRADE JOURNAL.

EXPANDING Non-ferrous Foundry require FOREMAN to take charge of all departments. Top salary for good man. Contact H. E. COXHEAD, STRATFORD FOUNDRY, 15 Martin Street, Stratford, E.15. Phone Maryland 1786/1491.

FOUNDRY

SERVICE ENGINEER required by well known Foundry Equipment Manufacturers. Preference given to applicants residing in the South West Midlands or Birmingham-Coventry area. Non-contributory pension scheme. Write stating age and full details of past experience to Box RB986, FOUNDRY TRADE JOURNAL.

MACHINERY WANTED

WANTED.—Cupola 6/8 tons per hour, drop bottom, complete with Fan, second-hand preferred. State Price. Box WC983, FOUNDRY TRADE JOURNAL.

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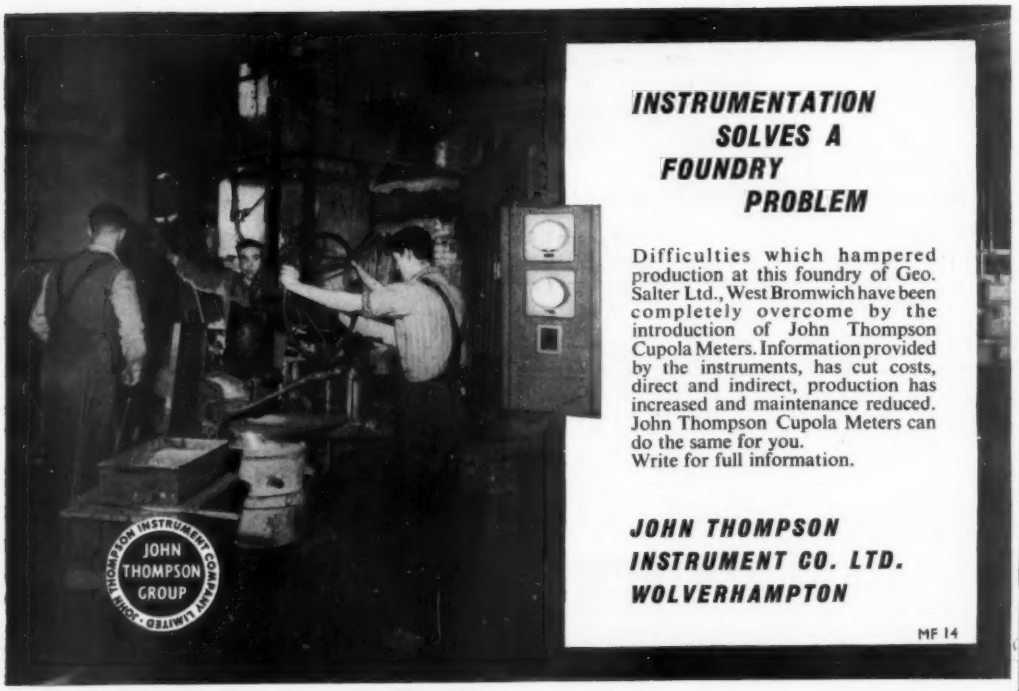

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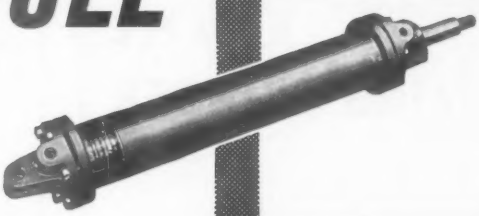

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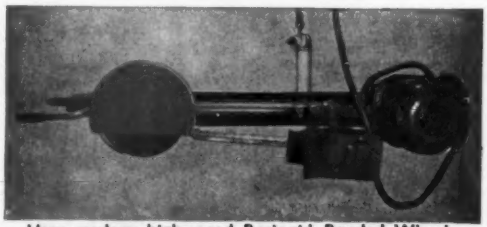

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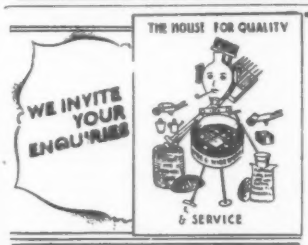

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WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. 109
No. 2295
Registered at the G.P.O. as a Newspaper

DECEMBER 1, 1960
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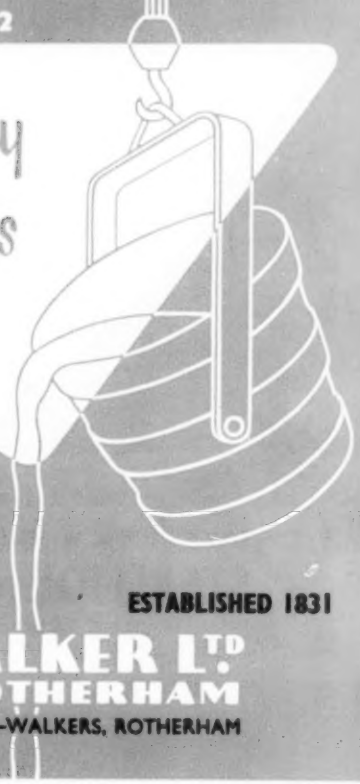

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